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PROCEEDINGS
# of the
CONFERENCE ON THE TREATMENT AND DISPOSAL OF WASTES FROM VEGETABLE PROCESSING

PROGRESS AND RESEARCH NEEDS

held at
New Orleans, Louisiana
August 26, 1969

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UNITED STATES DEPARTMENT OF AGRICULTURE

PREFACE

This Conference was sponsored jointly by the Louisiana Sweetpotato Commission; Department of Horticulture, Louisiana State University, Baton Rouge, La.; and USDA's Southern Utilization Research and Development Division.

Proper disposal of plant wastes is a problem confronting all industries. Although individual companies and industry in general have expended much effort to abate air and water pollution, progress has been less than adequate. The primary objective of this Conference was to assist vegetable processors with the proper and efficient disposal of plant wastes.

Problems confronting the vegetable processing industry, techniques currently available for the abatement of water pollution, and the type of research needed for further advances were discussed.

These proceedings report in full the statements presented by the various speakers during the conference and give an account of the discussions following.

C. H. Fisher, Director
Southern Utilization Research and Development Division

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WELCOME

by

C. H. Fisher, Director
Southern Utilization Research and Development Division
New Orleans, La.

It is a privilege and pleasure to welcome all of you to this Conference on behalf of the Southern Utilization Research and Development Division (SURDD).

I bring greetings also from Fred R. Senti, Deputy Administrator of the Agricultural Research Service, Washington. He wanted to participate in this Conference, but pressing business made this impossible. Dr. Senti is in charge of the Department's five large Utilization Research and Development Divisions, and hence is a very busy man.

Some claim that we are entering the crucial decade for humanity. Several danger signals are cited, including pollution hazards, population explosion, microbial proliferation, and growing disproportionation of food supply. Some are pessimistic about solving pollution problems, saying that performance will not be commensurate with talk.

There are at least some reasons, however, to feel optimistic. Pollution problems can be adequately handled if two broad conditions are met: First, there should be a full awareness of the problem and the determination to solve it; and, second, the necessary technology should be available or attainable.

There is much to indicate that we now have a wide awareness that pollution is a serious problem. We read about it frequently in the press and in both popular and technical magazines. We hear about it at conferences and on radio and TV.

Time magazine recently introduced its new section called *Environment* with the words:

"Even as the world celebrates the astronauts' triumphant return from the moon, more and more people are increasingly alarmed by man's abuse of his own earth. The concern is perhaps strongest in the U.S., where America the Beautiful can all too often be described as America the Polluted, and anxiety about the quality of life has become a rising political issue. Yet the worries extend to every society around the globe where ever-growing industrialization has created a crisis of excessive waste that is poisoning—and not always slowly—plants, wildlife, and indeed man himself."

A poll was taken recently to learn the views of the public regarding cuts desired in Federal spending. The results ranked pollution control as an activity that deserves continuing support. Only one other activity, aid to education, received a higher rating than pollution control.

There seems, then, to be a public awareness of the pollution hazard.

Do we have the technology needed to solve the problem? Certainly, in general terms, we have an excellent technology. Our annual expenditure in the United States of some $26 billion on research and development is providing more technology. And, of course, some technology for combating pollution is already available.

At this Conference, information on available technology will be exchanged and the need for new technology will be identified. We have an excellent program, well-qualified speakers and chairman, and a splendid audience. I am convinced that, with all these favorable circumstances, we shall have a profitable and successful Conference.

I wish to invite all of you to visit our Laboratory on the lakefront today or on any occasion when you are in New Orleans.

I wish also to thank the Louisiana Sweetpotato Commission and LSU's Department of Horticulture for joining our Division as sponsors of the Conference. Over the years, we in the Southern Division have also had the privilege of cooperating with these two organizations in research, particularly that on sweetpotatoes.

I wish to thank everyone who has contributed to the planning and implementation of this Conference. Special thanks go to:

General Chairman and Chairman of the Program Committee, Randolph J. Trappey, Jr., and all members of the Program and Executive Committees.

Bernard F. Trappey, Chairman, and J. J. Arceneaux, Director of the Louisiana Sweetpotato Commission.

D. W. Newsom of the Department of Horticulture, LSU.

B. H. Wojcik, Assistant Director, who represented SURDD Division in making arrangements, and his assistants.

Our speakers and session chairmen.

And our audience.

I hope that participation in the Conference will be enjoyable and rewarding for all, and that vegetable canners will return to their factories with at least *partial* answers to their pollution problems.

INTRODUCTORY REMARKS

by

R. J. Trappey, Jr.
B. F. Trappey's Sons, Inc.
Lafayette, La.

I am privileged to have been selected by the Louisiana Sweetpotato Commission and the Department of Horticulture, Louisiana State University, as the Chairman of this Conference on the Treatment and Disposal of Wastes from Vegetable Processing. We, the processors of various vegetables—primarily sweetpotatoes—need *not* be reminded that waste disposal involves, not only problems of pollution of our rivers and streams, but also the disposal of chemical wastes and the large percentage of bulk residue from our operations. This is probably the most serious problem facing the industry at present time. It is for this reason that today's brief but comprehensive conference is being held. We will obtain the views of a large number of technical specialists, officials responsible for stream control, leaders in the area of research and development, and plant operators themselves—all of whom will be participating in the agenda. We have a rather crowded program for a 1-day session, and I hope that the panelists especially will be mindful of the time needed by their associates on the program. I am requesting the presiding officers in each of the panels to limit presentations to approximately 10 minutes.

We are grateful to C. H. Fisher, Director of the Southern Utilization Research and Development Division and to the Agricultural Research Service of the USDA for arranging, in cooperation with the Louisiana Sweetpotato Commission and the Department of Horticulture of Louisiana State University in Baton Rouge, this meeting; and to the Executive and Program Committees for bringing together an impressive group of conference participants.

We would like to express a special note of appreciation to the Federal Water Pollution Control Administration of the Department of the Interior for providing us with a most distinguished member of their staff—Mr. William J. Lacy—to present the keynote address. In the past Mr. Lacy has given us valuable assistance in facilitating contracts with members of his Washington staff. Robert Lafleur of the Louisiana Stream Control Commission in Baton Rouge has been equally helpful to us in the State of Louisiana not only in facilitating contacts with members of his organization but with the Bureau of Forestry as well.

I regret that, in the interest of conserving time, I cannot give individual credit to every participant on the roster. I wish, however, to express appreciation for the effort that each has expended in preparing the information for this meeting. Because we have an excellent group of speakers and chairmen and an interesting program arranged by the Committee, we are confident that this will be a successful meeting.

We appreciate the concern you have shown in our problem on the treatment and disposal of sweetpotato and vegetable wastes by attending the conference. I urge everyone in the audience to strive for maximum benefits from this meeting by taking an active interest in the subject, by exchanging freely their views, problems, and corrective measures evaluated on the abatement of stream pollution that may result from the processing of vegetables. Additionally, I hope that the information which will be presented will lead to the conservation of water, the elimination of chemicals and other pollutants from processed foods, and that this objective will be achieved at minimum additional costs to the consumer as well as the taxpayer.

POLLUTION PROBLEMS AND SOLUTIONS FOR THE VEGETABLE PROCESSING INDUSTRY

by

W. A. Mercer
National Canners Association
Berkeley, Calif.

INTRODUCTION

As food processors, we know that we must have an adequate supply of water. We know that for the most part the water we use must be clean water. There can be no deviation from the high standards we have set for product quality and plant cleanliness.

We cannot, therefore, in good conscience argue against any antipollution measure which is necessary to protect the quality of our water supplies. In my mind I always underline the words *necessary antipollution measures.*

We know that as food processors we are producing large volumes of strong wastes. We know that there are pollution problems. We cannot afford to be complacent if the situation affects the future of the food industry and the communities of consumers. We cannot afford to shirk any responsibility either collectively or individually, which may be ours in solving these problems.

As you may know, most of the States have finalized their water quality control plans. This has been done in compliance with guidelines established by the Federal Water Pollution Control Administration.

The preamble to the guidelines can be summed up in this statement: "No one has the right to pollute public waters."

In substance the Federal policy on pollution abatement says:

1. No stream can be used for the sole or principal purpose of transporting wastes.
2. No body of water can be used to assimilate or treat wastes.
3. No degradation of existing water quality in a stream can be allowed.
4. No wastes amenable to treatment or control can be discharged without treatment or control by the best possible method available.

Knowing this to be Federal and State policy on pollution abatement what master plan for cooperation and—perhaps survival—should we follow?

Since good growing and food processing must produce and accumulate waste materials, we ought to attempt to see where we stand and to foresee what changes the future will bring in the food industry.

As you know, the methods of growing foods have now undergone drastic changes which will continue as economic pressures mount. People are no longer willing or able to perform, efficiently, the laborious tasks in the production of foods. These tasks must now be largely done by mechanical means.

In producing 1 pound of food for the consumer household requires that 5 to 10 pounds of solid wastes be left in the field or factory and that many gallons of clean water become waste water.

For example, 3 pounds of manure results from the production of 1 quart of milk. Each pound of weight gained for an animal produces 6 to 25 pounds of manure.

The tonnage of stalks, stems, leaves, and cull fruits left in the field or orchard far exceeds the tonnage of crop harvested and hauled to market. The ear of corn is but one-third of the total plant weight, and the tomatoes actually harvested, equal but one-fourth the weight of residue left in the field. Today we know the tonnage of green and discarded fruit left in the field by mechanical harvesting far exceeds residue left by hand-harvesting methods. This is the pattern which must prevail for crops intended for canning and freezing.

Today, because of machine harvesting of some crops, there has been a measurable increase in soil contamination of the raw product. This problem has not been more serious because of the commendable efforts of the processors to devise and install, at the plant, handling and washing procedures more effective in removing contaminations from machine-harvested products—but more water is required for the washing, three-times as much water for machine harvested tomatoes—and, therefore, more and stronger waste water down the drain.

In my opinion, we must perfect field-handling operations to the point that product delivered to the processor meets all requirements for quality. We must consider the possibility that some pre-processing operations should be done in the field or orchard —leaving there the solid refuse and waste waters to be handled by methods that prevent water pollution and other nuisance conditions.

Knowing that each processor, regardless of his location and present method of waste disposal, must make operational changes to reduce the strength and volume of waste waters discharged, adequate attention should be given to the following:

(a) The plant layout for collecting and handling liquid and solid wastes.
(b) The design of food processing equipment to prevent product spoilage and limit water use.
(c) The use and reuse of water to reduce wastewater volume.

a. *The Plant Layout*

Wherever possible, each newly designed plant, or modification of an existing plant, should provide in the layout for these important situations:

1. Each individual operation, and the total plant operation, should use as little water as is still consistent with an efficient and sanitary operation.
2. The waste water collection system should make possible the separation of strong waste from weak wastes and weak wastes from relatively clean waters.
3. The waste water collection system should make possible, if and when necessary, withdrawal from the plant of strong waste for on-site treatment before its final discharge.
4. The wastewater collection system should allow direct discharge to the sewer of weak waste waters not satisfactory for reuse in some way.
5. The water-use system in any plant should provide for collection and reuse of all relatively clean waters. If their reuse is not practical or desirable, the water collection system should provide for disposal of the waters other than to the sewer or plant-operated treatment system. Disposal to streams, storm sewers, and irrigation canals are all possibilities for such waters as condenser water, can cooling water, and other types of clean process waters.
6. With regard to solid wastes, every effort should be made to prevent water transport of these wastes. Water conveying of solid wastes causes a significant increase in the soluble solids that cannot be removed by screening. This occurs as a result of leaching of solubles from the suspended solids and disintegration of large suspended solids into small pieces that pass through the screening operation.

b. *The Design of Food Processing Equipment*

In the design of food processing equipment, in-plant observations emphasize the fact that little attention has been given to prevention of spillage of raw product and product ingredients from machinery moving the materials to and from unit operations. A recognized case in point is the syruping operation or addition of other packing media to the packaged products.

The National Canners Association (NCA) Laboratory, in cooperation with the Federal Water Pollution Control Administration (FWPCA), is planning a comprehensive study to pinpoint in-plant operations where significant product spillage occurs, to measure the waste load contributed by such spillage, and to demonstrate appropriate design modifications to prevent spillage. Some product spillage is so obvious in amount and effect on the waste load that research is not needed to emphasize the need for preventative means.

c. *The Use and Reuse of Water*

Reduction of water usage through reuse of water can pay real dividends in improving a waste disposal situation whether the discharge is to a municipal system or plant-operated system. Much emphasis on water use reductions or eliminations will be given in the in-plant study to be considered by NCA and FWPCA.

Water reuse is beneficial because:

1. Water is no longer a free commodity. It costs money to pump water; and it costs money to dispose of water, and it costs money as water.

2. A reduction in the volume of water used gives a corresponding reduction in the volume of liquid waste discharged. Where sewer service charges are based on gallonage a reduction in volume means a saving in dollars.

Although the total organic load discharged may not be reduced by water conservation, containment of the load in fewer gallons of water results in significant advantages. For example:

1. Hydraulic overloads on treatment plants can be as disastrous as organic overloads.

2. Treatment of more concentrated wastewaters is cheaper and more efficient than treatment of a dilute waste water. It must be remembered, a food processor, as a taxpayer, is paying for the building and operation of the sewage treatment plant which handles his waste.

Food processing waters cannot be reused indiscriminately. Their recirculation in contact with food products must allow satisfactory plant and product sanitation.

To give more specific guidance in the use of reclaimed waters NCA makes the following recommendations:

1. That the water be free of microorganisms of public health significance.
2. That the water contain no chemicals in concentrations toxic or otherwise harmful to man, and that no chemical content of the water impose the possibility of chemical adulteration of the final product.
3. That the water be free of any materials or compounds that could impart discoloration, off-flavor, or off-odor to the product, or otherwise adversely affect its quality.
4. That the appearance and content of the water be acceptable from an aesthetic viewpoint.

In addition to in-plant changes to reduce waste loads discharged to community sewer systems, what methods of on-site treatment should be considered for the present and future?

For purposes of this discussion I am defining on-site treatment as the removal of biological oxygen demand (BOD) by one or more mechanical or biological procedures. A further limitation would be the exclusion of solid wastes and sole attention of liquid wastes.

An effective screening operation to remove suspended solids is essential. With such wastewaters as those from tomato and vegetable processing an effective screening operation to remove not only large suspended solids but also small particles will give considerable reductions in BOD.

With fruit processing waters and waters from certain other processing operations, the removal of all suspended solids accomplishes comparatively little BOD removal.

In the case of tomato and vegetable processing waters, a larger percentage of the total BOD load is present in the form of suspended matter. In the case of fruit processing waters, 75 to 80 percent of the total BOD load is present in the form of soluble sugars and fruit acids not removable by screening.

However, in each case effective screening is essential. If the waste waters are discharged to a municipal system, the suspended solids can be a problem in the conventional processes for treatment of domestic sewage. At one stage in the process, suspended organic solids are removed by settling. Suspended solids from food processing operations are flocculent in nature and have a tendency to float or rise to the surface if gassification has begun.

The discharge of excessive amounts of suspended solids to ponds may aggravate odor nuisance problems. Suspended solids form floating pads of scum which interfere with oxygenation of the waste water—or the suspended solids form bottom sludge deposits that decompose anaerobically with release of malodorous gasses.

For the most part, chemical treatment of fruit and vegetable processing wastes has not been satisfactory. The soluble sugars in fruit waste waters are not removed by chemical treatment.

Essentially, treatment of food processing waste waters is dependent on microbiological action to change the nature of the organic matter into a stable form no longer capable of causing odors or water pollution.

This process requires that conditions be created and maintained in the waste waters which allow suitable microorganisms to grow and metabolize. A further essential requirement is time.

At present and in most cases, on-site treatment cannot be considered for the total plant effluent. Treatment of segregated streams, low in volume and high in organic concentration, is worth serious consideration in many cases and will become more compelling as time goes on.

Because, in most cases, there are space limitations around food plants, NCA has selected to emphasize research on aerobic, high-rate trickling filter towers. Research reports are available which discuss the results of these investigations

SUMMARY AND CONCLUSION

By way of conclusion, let me attempt to summarize the operational, political, and philosophical aspects of water pollution abatement, which I believe must receive attention from the food processing industry.

1. We must recognize and comply with the fact that adequate handling and treatment of wastes are necessary costs of doing business.
2. We must design, develop, and demonstrate raw product field handling procedures which leave in the field as much as possible of the contaminating soil and organic debris and the unusable fruits and vegetables. Serious study should be given to in-field, pre-processing operations.
3. Water use in the food plant which still allows an efficient and sanitary operation, should be reduced to the lowest volume possible. Plant engineers should keep reductions in water use uppermost in mind when new equipment is installed or other plant modifications made.
4. Politically and philosophically, we must be "for" water pollution abatement. We have no alternative. However, we must speak out when unreasonable requirements are proposed. Our stand should be that, although it will cost billions of dollars to abate pollution, more than dollars are required. Strong legislation and massive doses of money will not produce an "instant pollution free tomorrow."
5. We must point out to legislators and regulatory agencies that today we do not have all of the technical answers that are needed. We must say that government-supported research must continue and be expanded. Research must design large-scale, demonstration-type projects which will test the economic, as well as, the technical feasibility of various waste handling and treatment methods.
6. Finally, we must now accept the fact that the disposal of liquid and solid wastes is a serious problem. We must not depend on the hope that a change in State or Federal administrations will eliminate or lessen the need to plan for and initiate methods of preventing water pollution.

The Vietnam War has postponed research programs and more concerted enforcement actions. Changes in the Federal Administration may produce some vacillations in policy. But the need for water pollution abatement is here, it will grow, and must be met sooner or later if we are to continue to prosper as an industry and as a Nation.

SESSION I: Edward I. Daniel, Princeville Canning Co., St. Francisville, La., Chairman

PANEL: "Plant Problems and Corrective Measures"

Randolph J. Trappey, Jr.
B. F. Trappey's Sons, Inc.
Lafayette Plant, La.

The sweetpotato waste water and unusable bulk waste problems are based upon conditions existing during the 1958 canning season. Plant improvements made during the off-season, before the 1969 pack, have resulted in a considerable reduction to our water pollution problems during this season's pack. Additional improvements, including some plant mechanization and finer screening for collection of bulk in the 1970 pack, will result in further reductions in water pollution. This will be done particularly with respect to reduction of water requirements in waste screening of edible potato products.

At present, we divert all polluted lye-wash water to a lagoon for natural pH and BOD content treatment. Lye-peeled potato wash water is discharged at a peak of 6,450,000 gallons per annum as compared with a lagoon capacity of 4,900,000 gallons. This lye-wash is discharged through a 4-inch pipe to the lagoon. Therefore, the total lagoon capacity of 4,900,000 gallons is limited to approximately 80 percent of the total annual lye-peeled potato wash water.

No aerators are installed, so that the contents of the entire lagoon must, periodically, be discharged to the river at approximately 3-month interval, an operation which is resorted to during periods of downstream high flow of river water.

The cannery fluming and floor wash water are discharged via a 6-inch pipe into the Vermilion River at the rate of 61 million gallons per annum.

Additional effluents including 1,600,000 gallons of dumped okra brine and 1,090,000 gallons of retort cooling water are to be treated per annum. In terms of waste-water treatment, we are faced with installation of equipment to handle a total annual flow of 72,190,000 gallons of waste water to be screened and otherwise treated to comply with the standards of the Louisiana Stream Control Commission.

It is our objective to reduce the solids, the BOD, alkalinity, and chemical oxygen demand (COD) to meet the standards of the Federal Government and of the Louisiana Stream Control Authorities.

Our present plans include:

(a) Effectively screening the lye-peeled potato wash water and recovering as much as possible of the suspended (high pH) vegetable solids for disposal, as fertilizer, stock feed or of dried disposal matter.

(b) Economically treating the lye-peeled potato wash water, as rapidly as possible, within existing lagooning facilities, with the BOD and pH reduced to acceptable effluent standards.

(c) An alternate method to replace lagooning and aeration of lye-peeled potato wash water with compact and equally effective effluent treating equipment.

(d) Economically treating the cannery wash and fluming water containing a high percentage of soil washed from the sweet potatoes.

(e) Blending both the fluming and lye-peeled wash water to flow simultaneously into the lagoon, combining an efficient filtering system and expediting reduction of total BOD by operating suitable aeration equipment, thus expediting fulfillment of BOD, before continuous discharge of water to the Vermilion River in a manner acceptable to the standards of the Louisiana Stream Control Commission.

Before April 7, 1969, we understood that such methods of Cannery Wash Water Screening and lye-peeler wash water treatment, by reducing the pH and BOD by dentention of the latter, in ponds, met the standards for preparing effluent for discharge into the Vermilion River. On approach to our plant, the river is already extremely turbid and contaminated, possibly by other industrial wastes, by wastes from other municipalities, and definitely by BOD generated by the flow of water through swamp vegetation. From this standpoint, we understand the Stream Control Commission intends to eliminate this contamination and provide a flow of Vermilion River water of the criteria indicated by the proposed standards. We also understand the Commission intends to correct the present adverse river flow and drainage conditions which result in periodic reversal of the flow of the river—depending upon prevailing wind conditions.

We, as owners of real estate in our industrial and private properties and as lifetime residents of this area, are also interested in potential recreational aspects of the rivers and bayous on which we maintain residencies. We are thus, financially and ethically, concerned with reduction of stream pollution, including conserving large areas of our property presently assigned to effluent ponding. To be realistic, however, we must consider the costs of alternate means of effluent treatment and we have—before passage of the Stream Pollution Control Legislation—expended much of our time and money for extensive studies directed toward more efficient treatment of our cannery wastes.

In general, we are concerned with conservation of expenses for utilities, including costs of city utilities. We are concerned with treatment and recovery of all reusable water. We are also concerned with the costs of recovery and treatment of unusable effluents. Before the State became interested in establishing effluent criteria, we were engaged in a study of these problems including their resolution as an economic aspect of our own operations.

At the Lafayette Plant there are four sources of industrial effluents, exclusive of human sewerage discharged into the city system. They include:

1. A peak flow of about 36,000 gallons per 8-hour day of vegetable and cannery floor wash water, relatively evenly distributed over this operating period. This occurs during May through December. This is passed through a 0.023-inch before discharge.

2. A peak flow of about 50,000 gallons of lye-peeler wash water per 16-hour day, to settling ponds at an initial pH of about 14 which is reduced to 6 to 7 pH after about 72 hours in the ponds. The BOD at entry to the ponds is believed to approximate 30,000, and we discharge to the river at intervals of not less than 6 weeks and not until the river is at almost full flood stage and flowing into the direction of Vermilion Bay. Operations extend over approximately 70 days during the fall and winter season, terminating about December 20.

3. At regular intervals, we discharge a total of approximately 200,000 gallons of retort cooling water, devoid of contaminants, at an average temperature of 160° F. to the River. This is apparently 64° above the tentative permissible standards.

4. During the okra processing season, we must discharge at intervals of 1 hour approximately 900 gallons of used-okra fermentation brine with an initial salt content of 4.95 Baume corresponding to 3,300 p.p.m. This initial salt content is diluted to about 25-percent before discharge. The season extends from May through early October. Is this rate of effluent permissible and, if not, what corrective measure must we take? We are, independently, investigating this possibility but assume that authorities responsible for determining standards of water quality would be in a position to advise of corrective measures, or, at least, the sources of information whether governmental or commercial.

The direction of our investigations into effluent treatment will, to some extent, be affected by the final, specific water quality criteria established for the Vermilion River and for Bayou Teche. The method of treatment to be applied to our several types of effluent will also be governed by these quality criteria.

Approximately 1 year ago we were placed on the mailing list of the Library Division of the Federal Water Pollution Control Administration (FWPCA) and have received a number of helpful documents. We would appreciate any additional documents containing all information derived from your continuing studies of canning procedures including sweetpotatoes, okra, and dry packs.

I would like to thank William J. Lacy and certain of his coworkers in the Industrial Control Branch of the FWPCA for discussions held in Washington, D.C., with our consulting engineer, Charles V. Jenkinson.

Lowell Fitzgerald
Bush Bros. and Co.
Dandridge, Tenn.

Bush Brothers own Valley Canning Company, has two potato canning plants in Louisiana, one at Cecelia and the other at Ville Platte. We have been involved with these plants, through part ownership and complete control, for 4 or 5 years. We came down here to work these plants and I think our problem was a little worse then than it is now. We have improved and I will tell you a little about our operation and what we have done since we have been down here.

In our plants we use the same process that many of the other people here use. We prewash our potatoes and then convey them through a hot, diluted, caustic solution where much of the peel is removed and retained in the caustic. Then they go through a washer that washes off the remainder of the peel and caustic.

We think of our streams or wastes as being three types of wastes. First, we have the necessary disposal of the spent caustic from the peeler. Then we have another stream that consists of the water used to keep the peeled potatoes wet. One of the panelists here mentioned that it is necessary to keep the potatoes wet throughout the process. We have this water to dispose of and then the wash water from the cleanup of the plant. We also have the large pieces of solids from the trimming of potatoes. We basically have these four wastes: the spent caustic, the wash water, the cleanup water, and the solids.

We have three ponds at each of our two plants. They are about 6 to 12 feet deep and about an acre in size. We can hold all of our spent caustic waste for a whole season in these ponds, which we are doing. When the weather permits—when we are getting a lot of rain—we let some of this waste go out into the bayous. The other liquid streams are dumped into the bayous also.

Our other waste, our solids, we sell or give away. It's being used by farmers for feed and is being hauled off by some of the local people.

We have had various studies and tests made on our ponds where we are holding this used caustic and it seems that after the season the pH continually drops down. It doesn't drop down enough, however. It drops down from 12 to sometimes as low as 10½ and really what you have then would not be caustic, but more of a sodium carbonate waste. It's an undesirable-looking solution and it is claimed that it can kill anything. However, anytime you want to, you can walk out to our ponds and see turtles swimming around in the stuff. I don't know how they survive.

We also ran these various tests on the streams into which we discharge. We do not feel that you can detect any appreciable amount of pollution on the streams. However, I'm sure that according to Government standards if you are putting untreated wastes into the streams you are, in fact, polluting them.

I will mention some of the things we tried with the help of Dr. Johnson of Food Tech Department of the University of Tennessee. Some of the work they have done involves using two or three chemicals to coagulate and settle out the solids. This was relatively successful. I think offhand you can safely say that one can settle out around a third of the solids by this method. We're not doing this, but this is something that one might do in the fall that would help.

We are presently operating a pilot plant that belongs to the Western Regional Research Laboratory. We are working with the Western and Southern Regional Research Laboratories in the operation of this plant which uses the dry peel process that was mentioned before. I guess maybe I differ a little from some of the others. I have great hopes for this, you might say, process modification. While our operation so far has indicated that the finished product did not have the smooth, slick appearance which our present process gives, we're still operating the pilot plant and have hopes of modifying this process so that we will get this nice appearance. Let me also add that we would be happy to have any of you visit our plant to observe the operation of this pilot plant. Of course, working with the Government as we are, there will be a time when the information that we gain from the operation of this pilot plant will be made public and you will hear more about this later on in the program.

Just to give you some idea I might mention that our total water usage at each plant is around 300 gallons per minute or a total of about 600 gallons from the two plants.

George B. Statham
United Foods, Inc.
Hammond, La.

(No copy of this paper is available for publication.)

Gordon S. Brown
Bruce Foods, Inc.
New Iberia, La.

(No copy of this paper is available for publication.)

H. W. Horton
King Pharr Canning Operations, Inc.
Oak Grove, La.

I would like to outline our particular situation at the King Pharr plant in Oak Grove. We treat the potatoes first with a steam peeler made by Food Machinery. The potatoes are then washed and placed in a lye solution. The potatoes are washed again with approximately 150 gallons of water per minute. The wash water then travels to a screen system where the solids are removed down to one-eighth of an inch. Then the wash water goes on to a holding pond which is approximately 10 feet deep and has a surface area of 5,000 square feet. Then it goes into a second holding pond which has a surface area of 80,000 square feet and is 6 to 7 feet deep. In each of our ponds we have two aerators. After the water leaves the second pond, it travels to a bayou which is located some 15 miles from the plant where the wash water enters the main stream of water.

Until 1969 all of our water used in the plant was directed to our oxidation ponds. We use approximately 300 gallons of water per minute. This year we have redivided the water. The water from different washes bypass the oxidation ponds and go into the main streams. The water that is used for the peelers goes into the oxidation ponds. We feel that by doing this we will have a much longer holding capacity. The problem that we ran into during 1968 was a low oxygen content of the water some 15 miles away from the plant. We feel that by making the changes we made this past year, we will be able to eliminate this problem.

I'd like to say that the pollution people that I have been in contact with have given us some very good suggestions. I might add that we have only one plant that works on the oxidation process, so my particular company has not put a lot of research into the pollution problem like some of the other canners; but, by working with the pollution people and the people here today, I am looking forward to some interesting points. We can work together and help solve these problems.

I think the problem in my particular operation is the lye solution. If we could filter more of these solids out before it goes into the pond, it would advance much faster. Any suggestions that the pollution people can give us will be helpful and we will be happy to work with them. I assure you that we will do everything we possibly can to help eliminate the problem.

Robert A. Lafleur
Louisiana Stream Control Commission
Baton Rouge, La.

I am a little dismayed at the fact that I am on the other side this morning. Your Chairman introduced me as Chief of Division Water Pollution Control and Executive Secretary of the Louisiana Stream Control Commission. I'm going to sound like some sort of god. I think that we can reduce all of this fancy terminology and get down to the basic problem of discharging into the streams material which degrades the value of that stream.

We think it should be—when I say "we," I speak collectively. I will assure you that when you hear from me it is because some of these field inspectors have found that you have gotten in trouble or I have gotten complaints from the general populace. There are times, believe me—and particularly when I hear from the general populace—when I am almost convinced that I am the guy that must be the one who is doing the contaminating.

At least I am being blamed for it. I heard some comments made by earlier speakers this morning which sort of tracked what some of my thinking was, and to repeat some of these comments might be, in fact, somewhat redundant.

One of the events that occurred in the past few years while I served as Secretary to the Water Pollution Control Authority of the State was this Federal Water Quality Act of 1965, which required that all the States submit to the Federal Administration a set of water quality standards on streams. I hasten to add—and I am quite convinced in my own mind—that Louisiana—and I would like to think the rest of the States are no different and if we are different, then so be it—has an 11th commandment which says, "Thou shalt not pollute." Of course, I must reluctantly submit that we do have some sinners. I'm not so sure that we're going to abate this thing, but I hope that cooperatively this will be accomplished at least within limits. Further limitations were submitted in connection with the Water Quality Standards through Washington which Louisiana adopted in July of 1967, which said that we would provide the best practical treatment to our wastes, both domestic and industrial. In the Water Quality Standards Act which was submitted, we also listed the uses to which these streams are being put and we tried the best we could to list the uses to which we felt these streams could be put in the future.

Within the past 3 or 4 years, we have seen an industrial influx in Louisiana. During the period beginning in late 1963 and at least until mid-1967, we witnessed in this State the industrial influx here—if you count it in terms of money invested on the capital investment basis—of some 3 billion dollars. Most of it was in the field of chemistry, a new thing to us, but it was straight chemistry and, of course, petroleum refining and things of that nature. It is only natural that this thing should come about and you wonder why, and the answer is rather simple. We had a comparably good supply of water. Mother Nature had endowed this State with apparently inexhaustible supplies of other natural resources. We have all the salt needed. We have all the natural gas. We have sulfur; we have the oil. I again repeat it was only natural that this sort of thing would come. I might add, too, that perhaps some 70-percent of this industrial expansion is located on the Mississippi River. This would include Baton Rouge and metropolitan New Orleans. Some 20-percent of this is located in the Lake Charles area and the other 10-percent is scattered throughout the State. These things are creating some problems for us, believe me, and we have watched the situation deteriorate rather rapidly.

I'm sure many of you recall, if you read the Saturday Evening Post, that the Mississippi River was described as the lower bowel of America. It receives the discharge of man and surface runoff from 30 States of the United States and a couple of Canadian provinces. The fact that we can still use it for the uses to which we like to put the water supply is indeed a tribute, I think, to the endowed man; but, we are running into this—we are running into a situation where many of the small water plants are no longer able to put out a good supply of drinking water.

Mr. Brown said a minute ago that he felt it was not only him but also the sugar mills. In 1958 or about that time—and this has nothing to do with the processing of sugar or the manufacture of sugar, but certainly relates to it—a particular sugarcane was using pesticide in the treatment of the sugarcane field. When these materials were discharged, time and time again I saw as much as 7 or 8 miles of streams covered with the whites of dead fish and it always followed—these things always happened about the time the pesticide application seemed to begin and would end about the time it ended. Usually a heavy shower was preceded by the application. My staff and I were called out to inspect these fish. Believe me, we hear about this. We hear about these rather harsh pesticide applications that are being used and it was not uncommon during seasons of application in the past for us to record, check, and investigate some 40 or 50 such fish deaths caused by pesticide, but now we are only recording some four or five during that same period of time so I am really thankful for that much.

What we find here, gentlemen, is a stream that has little or no flow. That flow has a magnitude of 45,000 gallons a minute. Located on that same stream are 10 sugar mills, each one using about 4,000 gallons of water a minute. So if you multiply the 10 times the 4,000, you run into 40,000 gallons of water. The flow of the stream is only 45,000 gallons, so your discharge of water almost equals the flow. So we had then, for all intents and purposes, a static cesspool, and we had it last year. Because of the sulfide in there, silver begins to tarnish and white paint on houses begins to turn gray. People get awfully unhappy—believe me, I hear about it.

I can't help but feel—and we take weekly looks at each of these sugar mills—the oxygen demand in that water is excessively high because there is no flow. I can't help but also observe that most of the oxygen in that water started off as sugar. Instead of contaminating the water, I would much rather see it sacked. Maybe I wouldn't pay quite as much for a pound of sugar. At any rate, it got to where it caused a lot of commotion. I would like to see these sugar mills operated a bit more efficiently so that more sugar can be put in the sack. On the Mississippi River —and I said there were other sugar mills—there are some 10 of them that are discharging caustic, acid, wash water, and condenser water into the Mississippi River. This is not necessarily by permit, but at least it is not prohibited.

The Board is in the process of trying to determine three things—(1) What is the level of treatment being applied to the waste? This is not necessarily in the sugar mills only; it includes all industrial waste. (2) What other treatments or technology can be applied. (3) What more will this Commission ask for? We hope and expect to complete this review by the end of this year. I have had the opportunity to speak to a number of you sugar mill operators. I have tried to give you a peek review or sneak preview of what this Board is confronted with.

We have certainly had our differences. We have talked to some of these plant operators. Many of you have had reviews before this Board in the past few years, and I have always tried to help you processors with everything I can. It's not with the intention of being vindictive when we do have our disagreements. I am only carrying out the responsibilities I am charged with.

I would like to say that much time and effort was spent by some of the best minds that we could get to work with the Water Quality Standards of Louisiana. The Standards in Louisiana were based on some 2 years of work in developing these Standards. They were also based on some 10 years of water quality monitoring, so we knew what was in these streams and we know also what we could expect.

I think we can stop and think for just a moment that if we preserve and protect our water, this water will take care of us, but if we degrade this water to the point that we can no longer use it, somebody's going to pay for it.

DISCUSSION

QUESTION: I would like to know the definition of secondary treatment.

MR. LAFLEUR: I will give you a quick definition. You may not like it. It's removing at least 98—well, perhaps as much as 85 percent of your BOD. I remind you that in our comments earlier we said that in many cases we don't know what secondary treatment is. We don't even know what primary treatment is, but the answer to your question is that secondary treatment is the removal of 85 percent of BOD material.

QUESTION: In case the 85 percent of BOD is not achieved, what control—

MR. LAFLEUR: I was afraid you'd ask that question, but I'll try one for size. We'll also have to go to determining who is not treating and, as I indicated earlier, we're looking here at stream use and not abuse. It occurred to me then if the 85 percent doesn't cut it, maybe you're abusing it. We have to consider abuse of that stream.

DISPOSAL OF VEGETABLE PROCESSING WASTE INTO MUNICIPAL SYSTEMS

James F. Coerver
Louisiana State Department of Health
New Orleans, La.

Combined treatment of industrial and domestic waste is an objective widely sought by industry. Where wastes are compatible and equitable charges can be arranged, a substantial savings in capital and operating costs can be realized by both industry and municipality. Many industrial wastes do, however, cause problems in municipal sewer systems and vegetable processing waste are one of the most troublesome.

Over the years, Louisiana municipalities have had some very unhappy experiences handling vegetables processing wastes in their sewer systems, particularly wastes from sweetpotato processing plants. There is much to be learned from these past experiences. An objective review of past mistakes may bring forth practical ideas for solution of the problems that have caused processors to be denied access to municipal sewerage systems. Although the case histories used for reference here involve sweetpotato canning operations, it is emphasized that other vegetable processing wastes have caused equally troublesome problems.

The first incident for review occurred in 1954. It involved a small sweetpotato canning operation near the city of Lafayette. At that time, Lafayette had an activated sludge sewage treatment plant designed to handle flow from about 40,000 persons and only about 30,000 persons were then connected to the system.[1] Obviously there was then available an industrial waste treatment capacity "equivalent" to the waste from 10,000 persons.

The engineer for the vegetable processor researched available information on the subject and estimated that flow from the plant would be about 30,000 gallons per day and would have a pH of about 11.0. It was planned to dispose of the caustic peal liquor wastes separately from the municipal sewer system. The engineer estimated that the "population equivalent" of the cannery waste on a total solids basis would be only 1,200 persons, and 4,000 on a BOD basis. Since the treatment plant had capacity for an additional 10,000 persons, it was reasoned that the plant could easily handle the cannery waste (which had an estimated "population equivalent" of only 4,000).

The start-up of cannery operations occurred concurrently with a prolonged rainstorm. There was so much infiltration into the municipal sewer system that it was necessary to bypass much of the flow to the sewage treatment plant on the second and third day of cannery operation. On the fifth day of operation, the sludge in the activated sludge aeration tanks turned gray and bulked, and gave off a very disagreeable odor. No dissolved oxygen could be detected in the aeration tanks. Total process failure followed promptly, and the cannery was ordered to disconnect from the municipal sewer system.

In reviewing the situation in retrospect, it is now far easier to see the mistakes that were made than it was to anticipate them at the time the situation occurred. For instance, there was then very little information in the literature about the characteristics of the wastes from sweetpotato processing or surely a much higher solids content in the waste would have been planned for. Files on the subject indicate that moderate to good housekeeping practices were expected of the cannery operation by the engineer, but fortunately prevailing attitudes in the industry about "good housekeeping" frequently involve flushing everything down the drain rather than making efforts to collect solids for separate disposal.

The second major error was the improper use of a "population equivalent." Comparing total or suspended solids in sweetpotato processing waste with total or suspended solids in domestic sewage on a parts per million basis leads to serious errors. The solids in potato wastes are predominantly carbohydrate in nature but not so in domestic sewage. In this case, the municipal plant was employing the conventional activated sludge process and high carbohydrate content wastes encourage detrimental sphaerotilus growth and attendant bulking of activated sludge.[2] Furthermore, activated sludge plants in those days were designed with marginal process air capacity making them highly susceptible to "shock" loads.

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[1] Louisiana State Department of Health File "Lafayette Sewerage" Engineering Division, New Orleans, La.

[2] Black, Hayse H., Planning Industrial Waste Treatment, Jour. Water Pollut. Control Fed. 41: 1277, July 1969.

In design on the "population equivalent" basis, there was apparently a failure to recognize that the waste would be discharged over about an 8-hour period rather than uniformly throughout the day. This made the effect of the cannery waste on the treatment plant as much as three times what was estimated.

In spite of all the shortcomings cited, the operated might have succeeded if the wastes were fed uniformly to the sewer system, and would surely have succeeded if settleable solids were removed from the cannery waste before discharge to the sewer.

The second incident for study occurred in 1958 at the town of Franklinton in Washington Parish, La. The town had just completed replacement of an old primary sewage treatment plant with a modern biological filtration plant. The old Imhoff Tank was converted to an open top digestor, and new clarifiers, filter, and drying beds constructed.[3] On September 25, 1958, I had the pleasure of making the final inspection of this plant and found it to be in tip-top condition and producing a stable effluent.

A small cannery operating within the city limits had, about that time, received a court order to cease polluting a creek branch into which they had been discharging waste from their plant. A connection was made to permit all of the waste from a sweetpotato canning operation to be discharged to the city sewer. On October 29, I returned to inspect the sewage treatment plant at the request of the town's consulting engineer and was astonished upon viewing a condition that could be best described as "a horrible mess." The digestor had become completely full of sweetpotato solids and the supernatant and overflow lines became clogged so that solids were overflowing from the digestor. Sour sweetpotato solids were ankle deep over much of the plant grounds. The rock in the biological filter was stripped clean of biological growth so that it looked as if the filter stones had been freshly scrubbed with soap and water and then polished. The new treatment plant had been rendered completely useless by the wastes from a very small vegetable processing operation.

A visit to the cannery indicated that no attempt was being made to screen out solids or separate caustic peal liquor from the discharges to the sewer system. The cannery was given permission to connect to the sewer system without any consideration of the consequences by either the municipal officials or by the cannery officials. At the insistence of the State Health Department, the cannery was ordered to disconnect from the sewer system.

The lessons to be learned from the Franklinton incident are quite obvious. A great deal of investigation and planning is required to handle vegetable processing wastes in a municipal sewer system. Also, in the case of small towns, we ought to be thinking of treating municipal wastes in a vegetable processing waste treatment plant rather than the reverse, since a relatively small vegetable processing operation can often produce much more waste than a small municipality.

The third example involves a small town in Louisiana with an activated sludge sewage treatment plant and another relatively small canning operation. I would rather not identify the plant specifically. The canner had been notified to cease polluting a stream and was warned in advance that the waste from the operation could not be discharged into the municipal sewer system. Because it was the processor's contention that waste from his "settling pit" could not hurt anything, he made a "midnight" connection to the sewer system. The municipal sewage treatment plant, in spite of a relatively large reserve capacity for future growth, was completely disrupted and, of course, the culprit was promptly detected and ordered to disconnect from the municipal sewer system. This third example illustrates a problem I have frequently observed in dealing with vegetable processors over the years and that is an unfortunate lack of understanding of their waste disposal problems. Many processors have exerted great effort in ignoring or denying the problem rather than face its reality and work for practical solutions. However, the fact that this conference is being held is a clear indication that the industry is maturing and that such attitudes are on the way out.

The principal impediments to successful handling of vegetable processing wastes in municipal sewerage systems are the high suspended solids content and the extremes of pH caused by caustic peeling, acidic fermentation, and acid processing. In most cases, the waste streams causing insult to biological treatment processes by disrupting of pH are small in volume and can be isolated for separate treatment. In some cases, pH problems can be solved by process change such as using steam peel rather than caustic peel. In all situations, acidic or basic water streams must be prevented from entering municipal sewer systems or else they must be neutralized before discharge. Nearly all municipal sewer systems now use a biological secondary treatment process and all such systems are, therefore, highly susceptible to abrupt pH changes.

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[3] Louisiana State Department of Health File "Franklinton Sewerage," Engineering Division, New Orleans, La.

The matter of removal of suspended solids from vegetable processing waste is not complicated. Grames and Kueneman[4] did an extensive study on primary treatment of potato processing waste with by-product feed recovery in Idaho. The plants they dealt with produce waste waters quite similar to that produced by Louisiana sweetpotato canners. They found that BOD reductions of 10 to 15 percent, and suspended solids reduction of 25 percent can be accomplished merely by screening wastes through a six-mesh screen. Rotary-self cleaning screens or vibrating screens are really not all that expensive to install and operate. There is no valid excuse for the 3- and 4-inch potato solids observed in many of our processing plant effluents.

Grames and Kueneman also found that BOD's and settleable solids can be further reduced 60 and 90 percent, respectively, by the use of primary clarifiers with an overflow rate of 600 gallons per day per square foot. Treatment to this extent by the processors could have avoided most of the municipal sewage treatment plant failures experienced in the past, if the caustic peel liquors were also handled separately or the steam peeling process used instead.

One of the big objections raised by canners to proposals of primary treatment at the processing plant was the problem of handling the potato solids extracted by screening or primary sedimentation or both. Here again, Grames and Kueneman report the Idaho experience being that dewatered sludge from such operations could be sold for cattle feed for enough to recover capital costs of primary treatment in 2 to 4 years.

Economic factors are also related to proposals to treat vegetable processing wastes in municipal systems. Large city systems have a greater inherent capability in their treatment facilities to handle vegetable processing wastes than do smaller communities. Unfortunately, vegetable processing operations are usually located in the smaller communities—away from urban complexes—and are closer to the raw material source. Accordingly, vegetable processing operations frequently generate a far greater amount of waste to be treated than the small host communities generate in domestic sewage wastes. As mentioned previously this often means that the problem of combined treatment can be best approached from the consideration of treating domestic sewage in a vegetable processing waste treatment plant rather than the reverse.

In spite of the failures experienced in past attempts, vegetable processing wastes can be handled in municipal sewage systems, and in some cases can best be handled in municipal plants. Before a combined treatment effort is attempted, waste flows and characteristics must be determined well beforehand. There is adequate technology to determine if and what wastes can be handled by municipal treatment processes and what preliminary treatment processes must be used before discharge to the municipal sewer. Processors must diligently operate and maintain the pretreatment facilities for which they are responsible if combined systems are to be successful. Processors must also realize that any increase in production or change in processing operations nearly always has a profound effect on waste volume and strength, and such changes must be conscientiously reported in advance for evaluation of impact on treatment facilities.

Vegetable processors who believe the limitations on discharges to municipal systems described above are too restrictive should avoid use of these facilities and construct independent waste treatment plants.

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[4] Grames, Lloyd M., and Kueneman, Roy W., Primary Treatment of Potato Processing Wastes with Byproduct Feed Recovery, Jour. Water Pollut. Control Fed. 41: 1358. July 1969.

WASTE CONTROL BY PROCESS MODIFICATION

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Western Utilization Research and Development Division
Albany, Calif.

Essentially four alternatives are available for eliminating or reducing the wastes created during processing. First, the incoming product may be altered so that it will yield a lower amount of waste during processing. The overall process also may be modified to either eliminate the step which produces the waste or to obtain the waste in a more handleable form. Another alternative is to process the waste to produce useful byproducts which can be profitably disposed of or at least can give some return to pay for part of all of the processing. Finally, conventional treatment and disposal systems may be used to treat the waste so that it may be disposed of with minimal adverse effects on the environment.

The Utilization Research Divisions of the U.S. Department of Agriculture now have research programs under way in these alternate areas. The Northern Regional Research Laboratory, Peoria, Ill., has conducted extensive and successful studies on the byproduct waste from the fermentation industries and the cereal grain industries. For example, practically all of the byproduct solids from the distilling industry are now recovered by industry in the form of distillers' grains. These grains are valuable animal feed protein and vitamin supplements. They have become so valuable that the waste recovery is a profitable business.

The Northern Utilization Research and Development Division (NURDD) now has a program on the evaluation and complete processing of cereal wastes from the wet- and dry-milling industries. In some cases, the wastes will be handled through biological action at minimum costs. In others, it is expected that valuable products will be recovered and pay for part or all of the waste disposal operation. NURDD's large culture collection, which incidentally is the world's largest industrial collection, is being utilized to aid in these operations. Recent developments have also been announced concerning the reduction of liquid wastes from soybean oil refining.

Future developments in this field will be forthcoming and will assist in the economic solution to the overall national pollution problems.

The Eastern Regional Research Laboratory, Wyndmoor, Pa., also has work under way in the area of waste recovery. Their primary effort at present involves the recovery of certain possibly valuable compounds from the protein water effluents of potato starch plants. An integrated system is being developed in the Laboratory involving the technique of reverse osmosis, protein precipitation, amino acid recovery, and organic acid recovery. It is anticipated that if all of these recoveries can be made, the BOD of the influent to the lagoons at the starch plants will be reduced to 20 to 25 percent of that of the original secondary plant effluent.

At the Western Regional Research Laboratory, Albany, Calif., we are working on several waste abatement processes. One of these involves the waste created in the processing of olives. To become edible, olives must be treated in brines. After this treatment the brines are normally disposed of. These brines contain salts and various organic materials which lead to disposal problems. Several years ago chemists in the Fruit Laboratory at Albany found that these brines could be conditioned for reuse by filtering them through columns of activated carbon. Many of the undesirable components in the brines are absorbed by the carbon, and the brines can be reused. At present a pilot plant is carrying out this process, and feasibility studies are being made in cooperation with the National Canners Association.

Our primary effort in waste treatment involves process modification. We realized that the greatest source of the waste created in most fruit and vegetable processing plants is the peeling process. Typically, these peeling processes involve some chemical or thermal treatment or both to soften the skin area. The softened tissue is then eroded from the untreated tissue by the action of water sprays or vigorous washings. As a results, large amounts of organic materials enter the plant effluents in rather dilute solutions.

It was our opinion that one of the best ways to minimize the waste problem for these operations was to modify the peeling process so that the peel waste could be removed without using excessive amounts of water. That is, we set out to find a treatment that would condition the peel material in such a way that it could be removed mechanically without using excessive amounts of water. The result of this approach is the "Dry" caustic peeling process.[1]

The white potato was the first commodity investigated. This commodity represents a large industry in terms of pounds of materials processed, and the peel losses are relatively large, about 10 to 20 percent depending upon the type of product being made.

The "Dry" caustic peeling process for potatoes involves several steps. Wet-washed potatoes are contacted with a hot dilute lye solution. They are drained of excess lye and allowed to stand for about 5 minutes to allow the caustic to penetrate and to permit the temperature of the surface to equilibrate with the cooler interior of the potato. Following the holding period the potatoes are subjected to infrared heat for 1 to 2 minutes. The infrared heat activates the caustic and dries the surface layer of the potato. After conditioning by the heat, the potatoes are placed in a rubber-tipped mechanical peeler which abrades the treated outer surface from the untreated interior of the potato. Finally the potatoes are washed to remove a very small amount of soft sticky residue from their surfaces.

The equipment for applying the lye may be identical to that presently used in conventional peeling plants. Likewise, the holding belt does not require any particularly novel design.

Two types of infrared heating devices have been used. One of these was a rotating barrel 38 in. in diameter and 5 ft. long. The walls of the barrel were made of 3/4-in. perforated steel to which were attached 1/4-in. steel rods parallel to the axis of the cylinder and spaced 6 inches apart. The rods caused the potatoes to roll rather than slide in the barrel. The rotational speed of the drum was 2 r.p.m. Eight 15,000 B.t.u./hr. burners, arranged in two rows, were placed 5 inches above the inside surface of the barrel. Adjustment of longitudinal tilt provided variable retention time in the barrel.

A second infrared heating device consists of a live roll conveyor with the infrared burners mounted approximately 5 inches above the rollers. This type of applicator is more readily scaled up to production size. The live rollers impart a rotation to the potatoes passing under the burners which provides for a uniform heat treatment. Residence time under the infrared burners is usually about 1 minute. Slightly longer times may be required in the barrel.

The gas-fired infrared heaters are the type commonly used for space heating. Combustion takes place just in front of a ceramic mantle which radiates at 1,550° to 1,600°. A nichrome wire screen protects the mantle from contact with the potatoes.

Following the infrared heat treatment, the potatoes are placed into a mechanical peeler. Again, two types of peeling devices were used. Both units are rotating rubber-tipped rolls to abrade the treated surfaces of the potatoes. Sheet rubber with 1/2-in. rubber projections, known as Type SCM scrubber matting, was cemented to steel rolls. One peeler had three rolls 8-1/2-in. in diameter by 38-in. long. Two of the rolls were spaced 5-1/2-in. apart and the third roll was located between these two rolls with its top surface 5 in. below the top surface of the two upper rolls. All three rolls turned in the same direction. The top rolls turned at 450 r.p.m. and the bottom roll turned at 560 r.p.m.

The other peeler consisted of eight 5-1/2 in. diameter by 20 in. long rolls with their axes parallel and lying in the same plane. The separation between the rolls was 1/2 inch. All rolls turned in the same direction; however, adjacent rolls turned at different speeds. One set turned at 680 r.p.m. while the other set turned at 540 r.p.m. A belt mounted above the rolls served as a lid and also conveyed a part of the peel material away from the peeler.

The amount of peel removed is a function of both the quality of the incoming potatoes and the end use or products to be made. Satisfactory peeling can be obtained on fresh potatoes with few blemishes at about 8 to 10 percent peel loss. On the other hand, stored potatoes with growth cracks, blackspot, and other blemishes may require as much as 18 to 20 percent weight removal to effect satisfactory peel quality.

Following the rubber-tipped peeler, the potatoes were immersed in water for the first time in the process to remove a small amount of soft, semisticky residue that amounted to about 1/2 percent of the weight of the potato. A barrel or brush washer is suitable for this purpose. The potatoes leaving the rubber-tipped peeler were essentially free of caustic.

Examination of the peeled potatoes showed very little, if any, heat ring. The final peeled potatoes should be immersed for a few minutes in 1/2 percent sodium bisulfite solution.

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[1] Developed by R. P. Graham, C. C. Huxsoll, M. R. Hart, M. L. Weaver, and A. I. Morgan, Jr., of the Western Regional Research Laboratory.

The peel residue from the rubber-tipped peelers contains about 23 to 28 percent solids and a free caustic content of about 1.3 percent. This material could be burned or buried for land disposal, or it could be fermented and used in a mixed cattle feed.

At present, this pilot equipment is located at the Busch Bros. plant in Ville Platte, La., where we are using it to study the feasibility of using the "Dry" caustic peeling process for sweetpotatoes. The work on sweetpotatoes is being done through a cooperative arrangement between the Western Regional Research Laboratory, the Southern Regional Research Laboratory, and Busch Bros., Inc. Results of this work will be forthcoming.

FEDERAL ASSISTANCE AVAILABLE TO INDUSTRIAL POLLUTION CONTROL PROGRAMS

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Everyone knows now that water is a chemical compound whose smallest particle, or molecule, is composed of two atoms of hydrogen and one atom of oxygen, usually written H_2O. In nature, there is no such thing. The water of the cleanest mountain stream contains much besides H_2O. For one thing, it contains a considerable amount of free oxygen, molecules of two oxygen atoms, of O_2, as does all natural water. It also contains some salts which it picks up from the stones over which it runs, and from the soil on which it fell. It also teems with microscopic organisms and contains some carbon dioxide, CO_2. That gas, most familiar as the effervescence in soda pop, beer, and champagne, is associated with all living matter. When a chemist or chemical engineer has to have chemically pure H_2O, he has to produce it in a laboratory in quartz then guard it with extreme care against its natural tendency to dissolve other substances.

The approximate proportions of elements in the human body are:

	Percent
Oxygen	65
Hydrogen	10
Carbon	18
Nitrogen	3
Sodium	0.15
Chlorine	0.15
Total	96.3

That is to say, we are 96 percent air, water, and carbon, with a pinch of salt. In addition, our bodies contain about 1 1/2 percent calcium, 1 percent phosphorus, 0.35 percent potassium, 0.25 percent sulfur, and small amounts of 14 other elements, mostly metals.

Because of the hydrologic cycle, the total amount of water above, on, and in the earth is the same now as it ever was and ever will be. No matter what we do to it sooner or later all water comes back to be used over and over and over again.

The amount of moist air that flows over the continents varies considerably from country to country, region to region, and from time to time. Therefore, the amount of precipitation that falls anywhere varies.

For extremes: In some parts of India rainfall often exceeds 400 inches a year, yet on the coast of Peru, in the rain shadow of the Andes Mountains, rainfall is barely traceable—footprints can remain years before enough rain falls to erase them.

"The gentle pitter-patter of raindrops" is merely an expression for poets. Actually, each raindrop that falls is more like a tiny bomb that blasts away at whatever it hits. Watch rain, even gentle rain, fall on beach sand or a dusty road, each drop leaves behind its own miniature bomb crater.

Rain wears away mountains. It takes—thousands, millions of years, but eventually the ceaseless pelting of raindrops takes its toll. The Appalachian Mountains, old mountains (200 million years), have been worn down by the rain, snow, frost, wind—and these elements continue to work on them. Someday even the Rockies, Alps, Himalayas—now steep, bare, ragged, young, croggy mountains (60 million years or less) will also show similar signs of wear.

Rivers carve and sculpture the earth. Looking down at the Colorado River—that narrow, silver streak that runs along the bottom of the Grand Canyon—it's hard to believe that anything this puny could have gouged out the awesome 8-mile-wide, 1-mile-deep chasm that is America's top tourist attraction. Estimates vary, but some geologists say that the Colorado has been working on the canyon for about a million years.

It didn't take nearly that long for Niagara Falls to be cut back to its present 7-mile gorge. Based on the current rate of wear—3.8 feet per year—and allowing for certain variables, experts say that the Falls are from 2,500 to 3,500 years old. It'll be difficult to estimate how long it will take for the Falls to retreat all the way back to Lake Erie. Some $18 million in plastic surgery has been performed on the Canadian rim to keep the Falls from looking common ordinary rapids. In addition, more and more water is being diverted from the Niagara River to turn downstream generators. These changes alter the rate of wear considerably.

It's odd, but we really know very little about water.

As a liquid, nothing compares with water. It dissolves more substances than any other.

Nationwide we get more water than we need. Average precipitation in the United States is 30 inches a year. That's plenty if evenly distributed, but some of us get too much and others too little. For example, the Pacific Northwest's Olympic Forest is drowned with 140 inches each year. Nevada received 9 inches.

When it comes to useable water, we are exceedingly lucky. Less than 1 percent of the world's surface water is liquid and fresh, and approximately one-third of this is located here in our own Great Lakes. If you talk about one Great Lake you must include the others because, with the exception of Lake Michigan, they are linked together like a giant stream. This stream tilts east and flows steadily to the Atlantic Ocean.

Therefore, the world's largest body of fresh water is in continuous motion. Moving water cleanses itself.

The water in the average clean flowing stream contains enough bacteria to digest the few organic pollutants that might be in it, reducing them to harmless compounds. As long as excessive loads of pollution are not added, the stream bubbles along cleansing itself as it flows.

If raw, untreated wastes are dumped into the stream it triggers off a rampaging bacteria population explosion; this particular stream tumbles on, it picks up oxygen from the air. And as the water's oxygen content improves, the extra bacteria begins to die of starvation. Fifty miles or so downstream, most of the wastes will have been digested, that is, if no more wastes or other pollutants are dumped into the stream. By now the stream is on the way to recovery. Not quite as good as before, but almost.

Another 50 miles downstream the bacteria count will fall to normal, it's healthy again, fish and people can swim in it. That's how nature cleanses moving water.

We know little about water, and we know next to nothing about pollution. In reality, any substance in high dosage is a potential pollutant because it may restrict water use.

Too frequently people think of pollution as something they can see in the water that doesn't belong there.

Silt is the world's oldest pollutant. It was here long before man, but man aggravated the problem by stripping forests and clearing the fields until there was no ground cover to absorb the water and hold the soil. When land is bare, rain compacts it so that it becomes almost cement-hard. Then water runs over the surface, carving gullies on downgrades, taking soil, but one heavy rainstorm can wash it away in a few hours.

One expert estimates that the United States lost half its topsoil between the time Pilgrims landed (1620) and the Dust Bowl days of the 1930's. Each year, about 543 tons of sediment wash down the Mississippi River and settle in the Gulf of Mexico—a fact that many people in New Orleans are aware of.

Billions of dollars are spent to filter out the silt to make water useable. Silt chokes up rivers and streams, and fills up reservoirs. Lake Mead, formed by Hoover Dam, will probably fill up with silt in less than a hundred years.

Sewage is something else. It includes everything that goes down the drain in homes, apartments, factories, restaurants, hospitals, hotels, and so on: A type of pollution that is one of our primary concerns because bacteria in it can cause typhoid fever, cholera, hepatitis, dysentery, and other diseases.

Now there are thousands of new wastes originating from the industrial and chemical plants that are so complex in composition and stable in water, that they are hardly affected by conventional water and sewage treatment methods. In fact, in many cases, we are just learning how to detect their presence.

Heat is a growing pollution problem. We've had to clamp down on some industries that use water for cooling purposes and discharge it so hot to the streams and rivers that it increases the danger of diluted chemicals, slows down the natural purifying process of moving water, and kills fish. One can't see thermal pollution, but it has caused plenty of headaches in industrialized areas.

Pollution is killing Lake Erie. All lakes die eventually from eutrophication as silt and sediment fill them, and the shallows become marshes, and the marshes dry land. Normally, the process takes thousands of years. Erie is dying now, in our time, right before our eyes. Twenty or thirty years ago there were indications that eutrophication was seriously advancing. But nobody did anything about it. Entire species of fish have died out. Algae blankets extensive areas of the lake. What accelerated Erie's aging process? We are sure it was caused by uncontrolled discharges of municipal and industrial wastes, and the Federal Water Pollution Control Administration (FWPCA) intends to put a stop to it. That, in itself, won't be enough, but it will be a good start. Lake Erie has taught us an important lesson: Now we know that even large lakes can become grossly polluted.

FWPCA Program.—Recently there have been several important changes in the Federal Water Pollution Control program. Few Federal programs have been subjected to as many significant changes in the same period. The Water Quality Act of 1965 provided for water quality standards for the first time in Federal legislation and established the Federal Water Pollution Control Administration (FWPCA). In the spring of 1966 the new agency was placed in the Department of the Interior; enactment of the Clean Water Restoration Act followed in November 1966. The authorization not only vastly increased Federal grants for construction of sewage treatment plants, but also for research, development and demonstration of new or improved methods in the municipal, industrial, and joint waste treatment field. This part of the discussion will cover the FWPCA program, with emphasis on the industrial research and development (R&D) program, and will indicate areas of mutual participation and cooperation by and between the Federal, State, municipal, and industrial communities.

Research and Development Program.—The R&D program involves research development-demonstration. It has three components: An in-house effort, a grants program, and a contract program.

The in-house effort is carried out primarily through FWPCA laboratories in Corvallis, Oreg:; Athens, Ga.; Ada, Okla.; College, Alaska; Duluth, Minn.; Cincinnati, Ohio; Narragansett, R. I. and Edison, N. J. Besides concentrating on regional problems, each of these laboratories is also specializing in technical areas of national concern. Two of these laboratories are working on the development of physiological, biochemical, and toxicological methods for detecting and measuring the effects of pollutants: Duluth, on freshwater use and Narragansett, on marine waters.

In addition to the laboratory effort, continued emphasis is being placed on research and development work at various field sites and pilot plant facilities across the Nation.

Obviously, a successful research and development program in a national effort to control pollution, cannot depend solely on the competence available in the Federal Government. It must also incorporate the best scientific and engineering talent in the Nation's universities, private research institutions, industries, and in State and municipal organizations. FWPCA accomplishes this through extramural grants and contracts. More than 80 percent of the monies available to FWPCA for research, development, and demonstration are used in the form of grant and contract payments to municipalities, States, universities, industries, and individuals who undertake worthwile research, development, and demonstration projects in water pollution control.

For the first time, industry may participate in these grant programs. The grant recipient may construct a permanent waste treatment facility on its own property to develop and demonstrate new or improved methods of treating industrial wastes or otherwise preventing pollution, which method shall have industry-wide application. These grants can pay up to 70 percent of the project costs, to a maximum of $1 million. The Federal Water Pollution Control Act also provides grants for projects which develop and demonstrate "new or improved methods of joint treatment systems for municipal and industrial wastes." Capital and operating advantages are certainly possible if industries can discharge their wastes into municipal systems.

The grants program is a truly cooperative effort—a cost-sharing type of contract. However, in some of FWPCA's research and development, the Federal Government bears full cost, contracting with appropriate nongovernment entities for these services.

Through the grant and contract devices, FWPCA can support almost any worthwhile project related to water pollution control under almost any type of institutional arrangement. We have the means for assisting pilot-scale demonstration projects, as well as, Laboratory research.

Industrial Wastes.—Industrial wastes are the Nation's principal point sources of controllable waterborne wastes. In terms of the generally quoted measurements of strength and volume, the gross wastes of manufacturing establishments are about three times as great as those of the Nation's sewered population. Moreover, the volume of industrial production, which gives rise to industrial wastes, is increasing at about 4.5 percent a year or three times faster than the population.[1] Also significant is the variance of composition of industrial wastes, which contain all known pollutants of concern in water pollution abatement as well as some unidentified factors.

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[1] U. S. Department of the Interior, The Cost of Clean Waters, Summary Report, Vol. 1, January 10, 1968.

Wasteload estimates, based upon an estimate of the "average" quantity of pollutant per product unit, indicate that the chemical, paper, and food and kindred industrial groups generate about 90 percent of the BOD_5 in industrial waste waters *before treatment*, and that this amount is nearly three times as much as from the sewered population of the United States.

The Industrial Pollution Control R&D Program.—FWPCA's industrial R&D program has as its general objectives to help provide to each major industry a demonstrated, developed, and evaluated technology for the abatement or prevention of water pollution from individual or multiple wastewater sources. This is to be done by new or improved methods and techniques which have potential value for industry-wide application where no method exists or where existing methods are not adequate.

The cost for treatment processes for some industries are similar to those incurred for treating municipal wastes. Also, the unit operations and processes are, in many cases, essentially the same as in municipal waste treatment. Nevertheless, these generalizations may not hold true for all our industries. A need, therefore, exists to demonstrate the specific technology most suitable for each significant industrial waste type and to determine the costs and effectiveness associated with the resulting treatment system.

Currently we have more than 114 R&D demonstration grants and contracts going, totaling over $47 million with a Federal share of approximately $20 million.

These projects include:

Steel in Illinois, Ohio, and Colorado
Plating in Connecticut, New Jersey, and New York
Citrus in Florida
Potatoes in Maine, Idaho, and North Dakota
Chemical in New Jersey, Texas, and West Virginia
Tanning in Kentucky, Minnesota, and Massachusetts
Fish in Alaska
Poultry in South Carolina
Vegetable Canning in California and Oklahoma
Paper in Louisiana, Oregon, Georgia, and Wisconsin
Textiles in North Carolina and Rhode Island
Fruit in Washington

Water is the universal liquid of life and part of our very being. It is everywhere around us, in the air and earth, without it we could not survive, nor could any plant, animal, or other living thing.

It is a final necessity for which man has devised no substitute.

Consider our water. Consider it well.

SESSION II: Kenneth G. Weckel, College of Agriculture,
University of Wisconsin, Madison, Wis., Chairman

PANEL: "Commercial Processes Presently in Use"

George Ehinger
Dorr-Oliver, Inc.
Stamford, Conn.

(No copy of this paper available for publication.)

Fred M. Welch
Allis-Chalmers Manufacturing Co.
West Allis, Wis.

(No copy of this paper available for publication.)

Edgar G. Paulson
Calgon Corp.
Pittsburgh, Pa.

(No copy of this paper available for publication.)

VEGETABLE PROCESSING WASTE TREATMENT

Charles B. Grimes
Rex Chainbelt Inc.
Milwaukee, Wis.

I would like to discuss some of the areas where our equipment has been applied to the treatment of waste, and, also, illustrate application examples from related industries which could be of interest to you.

Screening is almost universally the first step employed in any waste treatment system. Vegetable processing wastes are no exception. Vibrating screens have been used extensively to remove coarse solids from the flow. I want to mention briefly that these types of screens are available through our Carrier Division.

Going further into primary treatment of these wastes, we have seen areas where grease has been a problem where vegetables are processed in conjunction with other foods, such as beef, and chicken, which account for the grease content in the waste flow. Such is the case at Libby, McNeil, and Libby's plant in Chicago, where meat and vegetables are processed in the same plant in the making of beef stews.

The primary treatment unit combines skimming for the removal of floating greases and bottom sludge collection of settled material (fig. 1). As flows increase with future expansion, it may become necessary to add a polishing step to this unit to stay within discharge limitation. Dissolved air flotation (fig. 2) has been used in many instances to further reduce grease and suspended solids content. This system utilizes unit effluent as a source for solution of air into water. The dissolved air is released as the pressurized steam passes through this valve and when mixed with the influent flow, the air bubbles attach to the grease and suspend particles floating them to the surface for removal.

Another similar application of this two-step treatment has been the clarification of waste from vegetable oil manufacturing as well as wastes encountered in the meatpacking industry. The gravity grease separator followed by spray irrigation has comprised a treatment system in soup manufacturing.

In the area of biological treatment, the trickling filter (fig. 3) is used as a means of supplying oxygen. Although this unit, as manufactured by our Pacific Flush Tank Division, is shown distributing the waste on rock media, in recent years we have seen a preference for the use of plastic media, such as that manufactured by Dow Chemical. When combined with final clarification, the system efficiency has been noted to be in the 40- to 85-percent range for BOD.

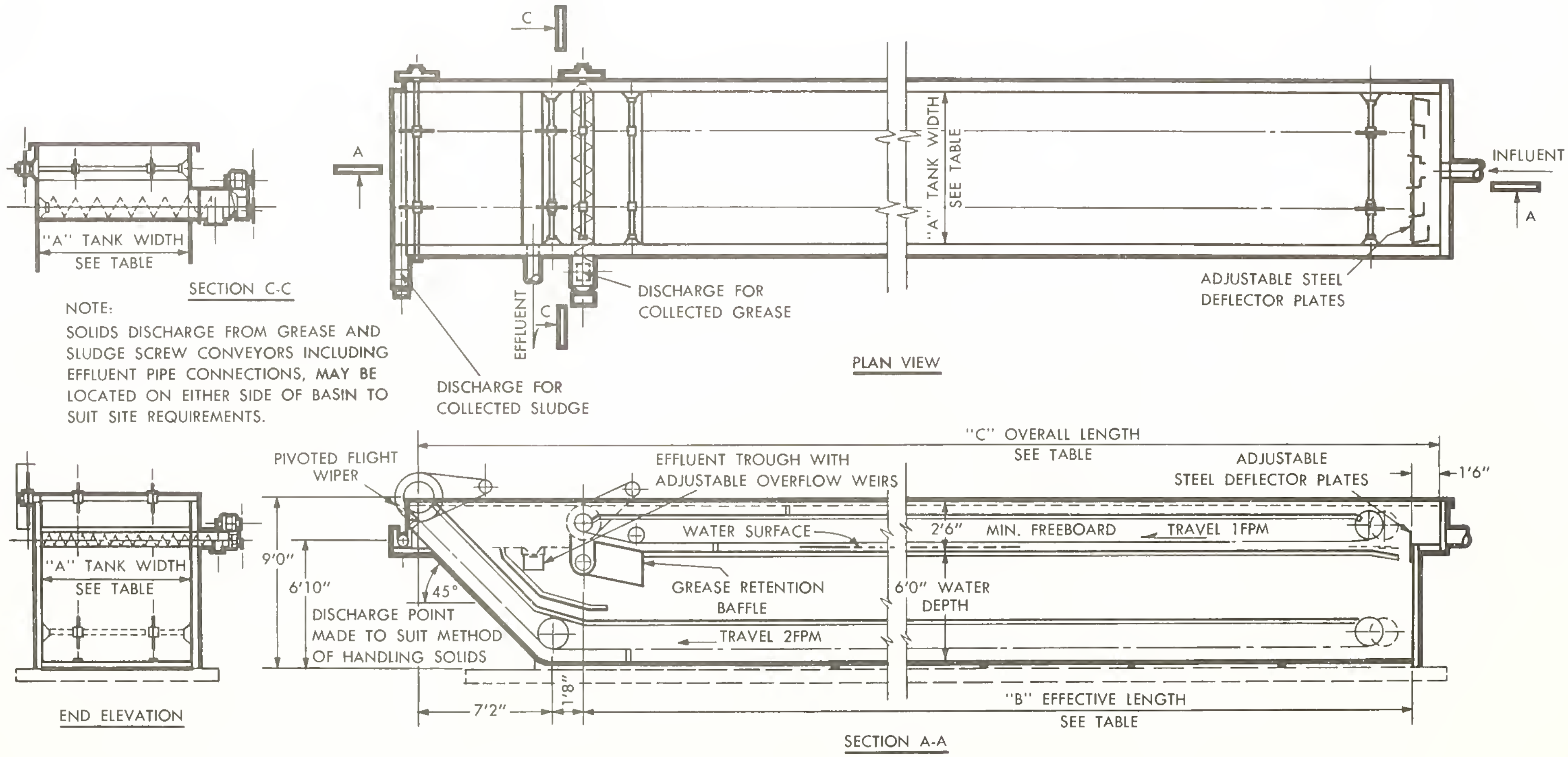
The activated sludge process has also been used in the treatment of vegetable processing waste. The A. E. Staley Company, producer of corn starches, syrups, chemicals, and feed products, uses this type of system to treat their wastes before discharge into the city sewer. This system approximates a completely mixed system and mechanical aerators (fig. 4) are used. This unit is basically an axial pump which pumps the waste from below the units and discharges it radically as shown in figure 5. Oxygen is transferred to the waste in the spray turbulence on impact and subsequent wave action.

At this plant, the Tex Tow-Bro replaced a conventional rake mechanism in the final clarifier for sludge removal. This device (fig. 6) is a suction type of removal mechanism and provides for a more uniform sludge removal, resulting in denser sludges. This particular arrangement has been used by many other food producers in the treatment of their waste. Removal efficiencies for this type of system have been reported as high as 95-percent for BOD and suspended solids.

In the disposal of the waste sludges from these processes, several alternatives are commercially available. Anaerobic digestion has been used successfully in several instances. Our unit is shown in figure 7. Sludge dewatering by vacuum filtration (fig. 8) has been used.

Where land area is available, aerated lagoons have been utilized for reduction of the pollutants. The floating mechanical aerator is particularly well suited for this application. Removal efficiencies in the 90-percent range have been realized by this method.

Although time has not permitted a detailed description of each and every method of treatment, literature which has been provided gives an overall picture of our company's involvement in this area.



NOTE:
SOLIDS DISCHARGE FROM GREASE AND SLUDGE SCREW CONVEYORS INCLUDING EFFLUENT PIPE CONNECTIONS, MAY BE LOCATED ON EITHER SIDE OF BASIN TO SUIT SITE REQUIREMENTS.

Figure 1

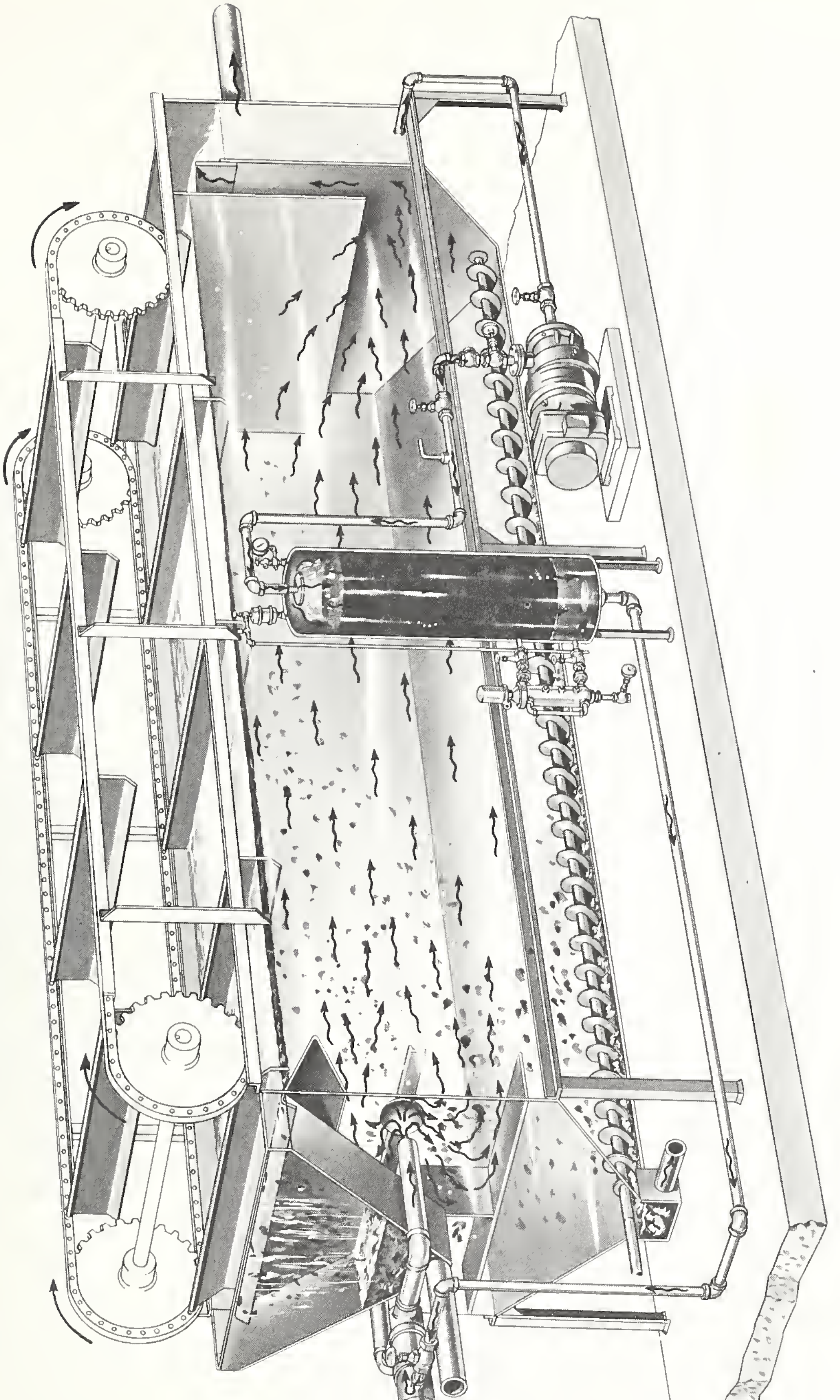


Figure 2

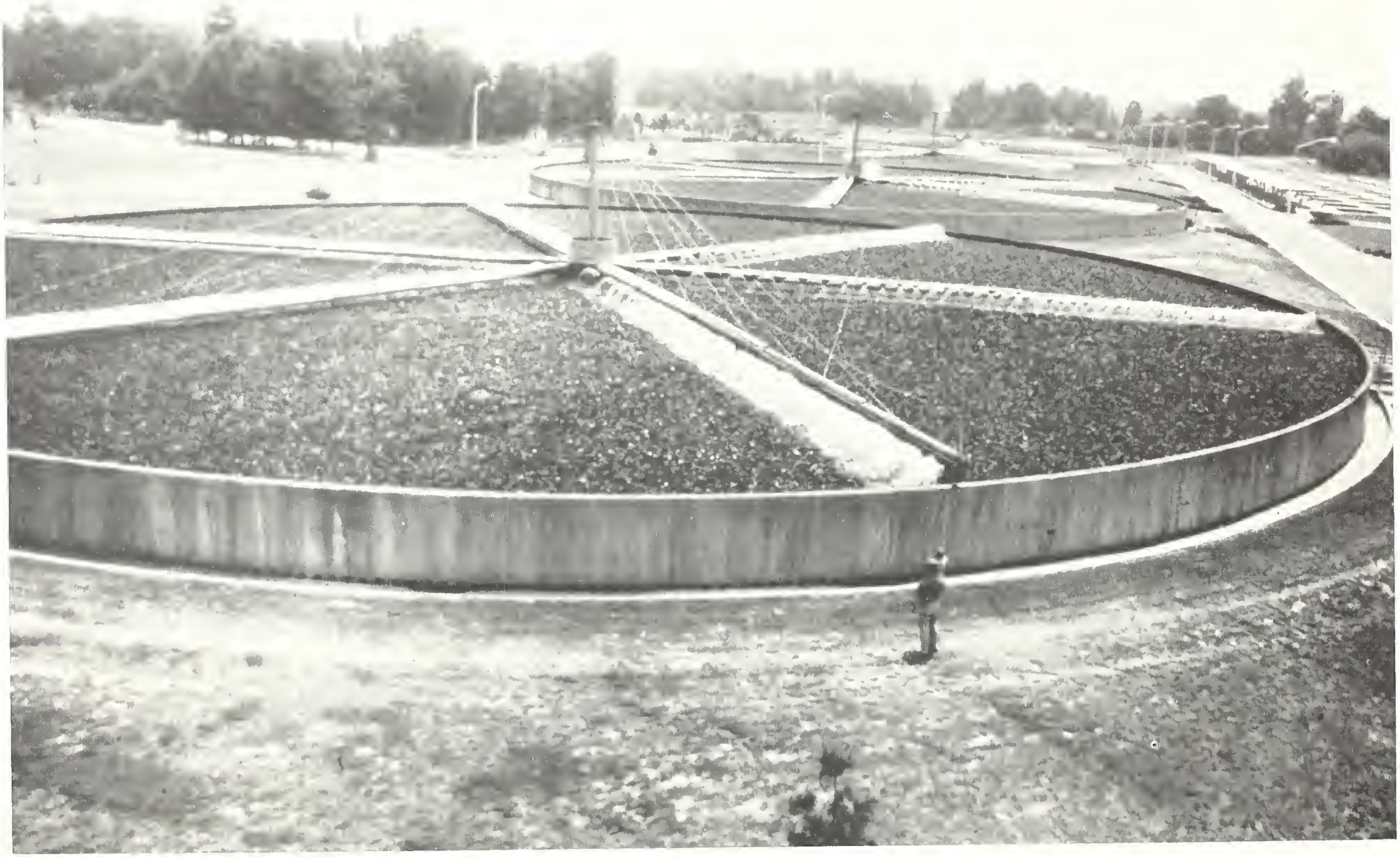


Figure 3

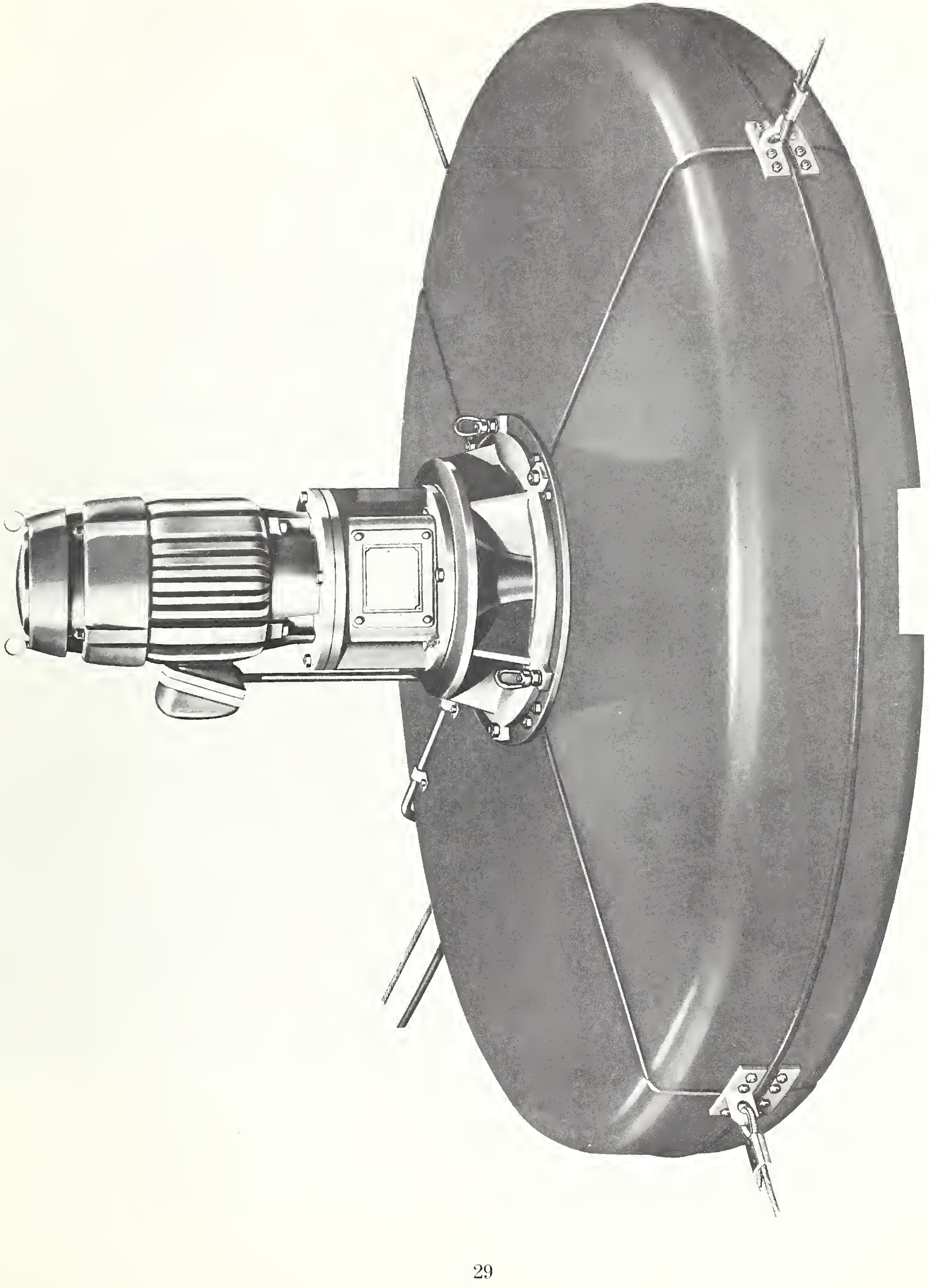


Figure 4

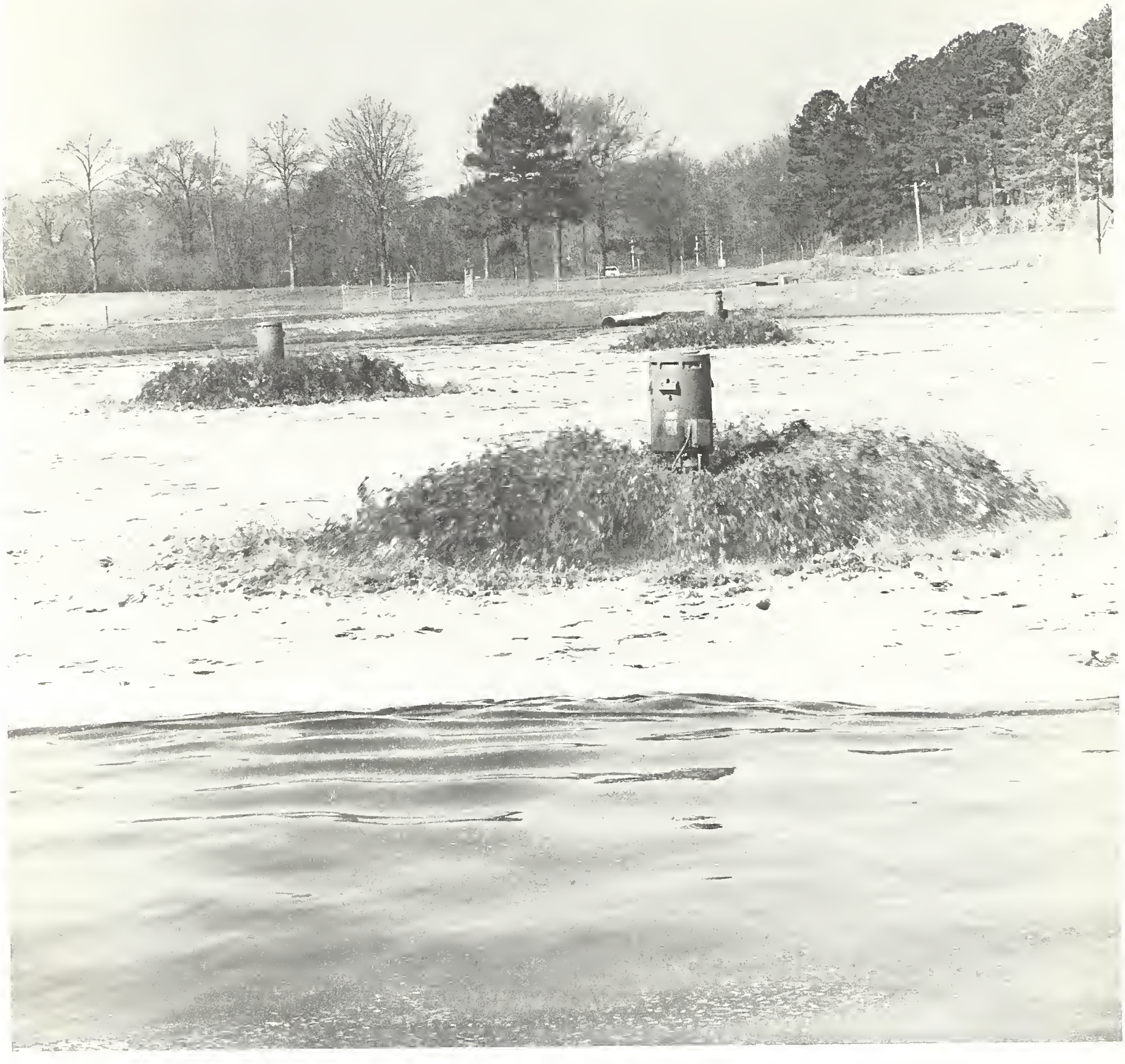


Figure 5

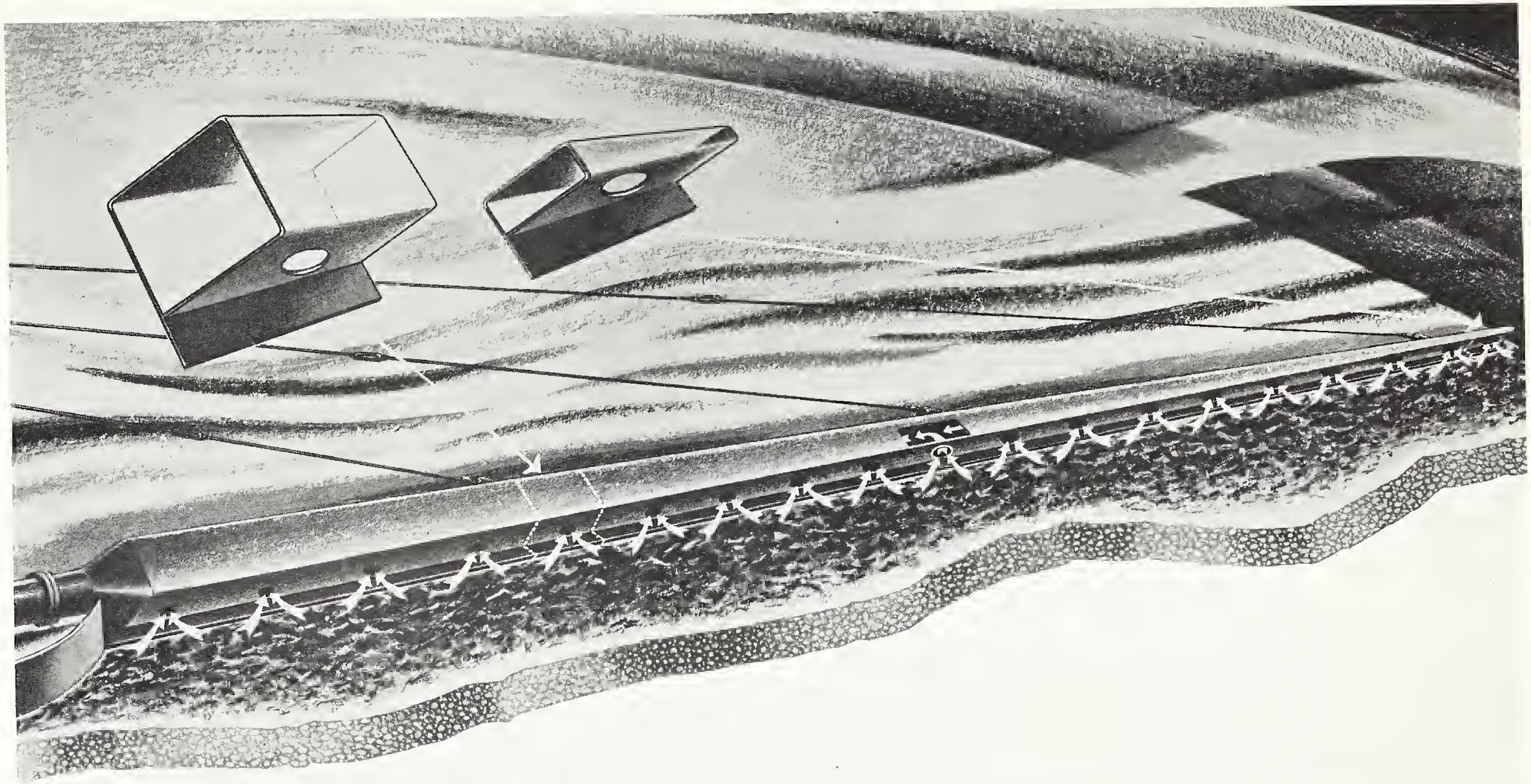


Figure 6

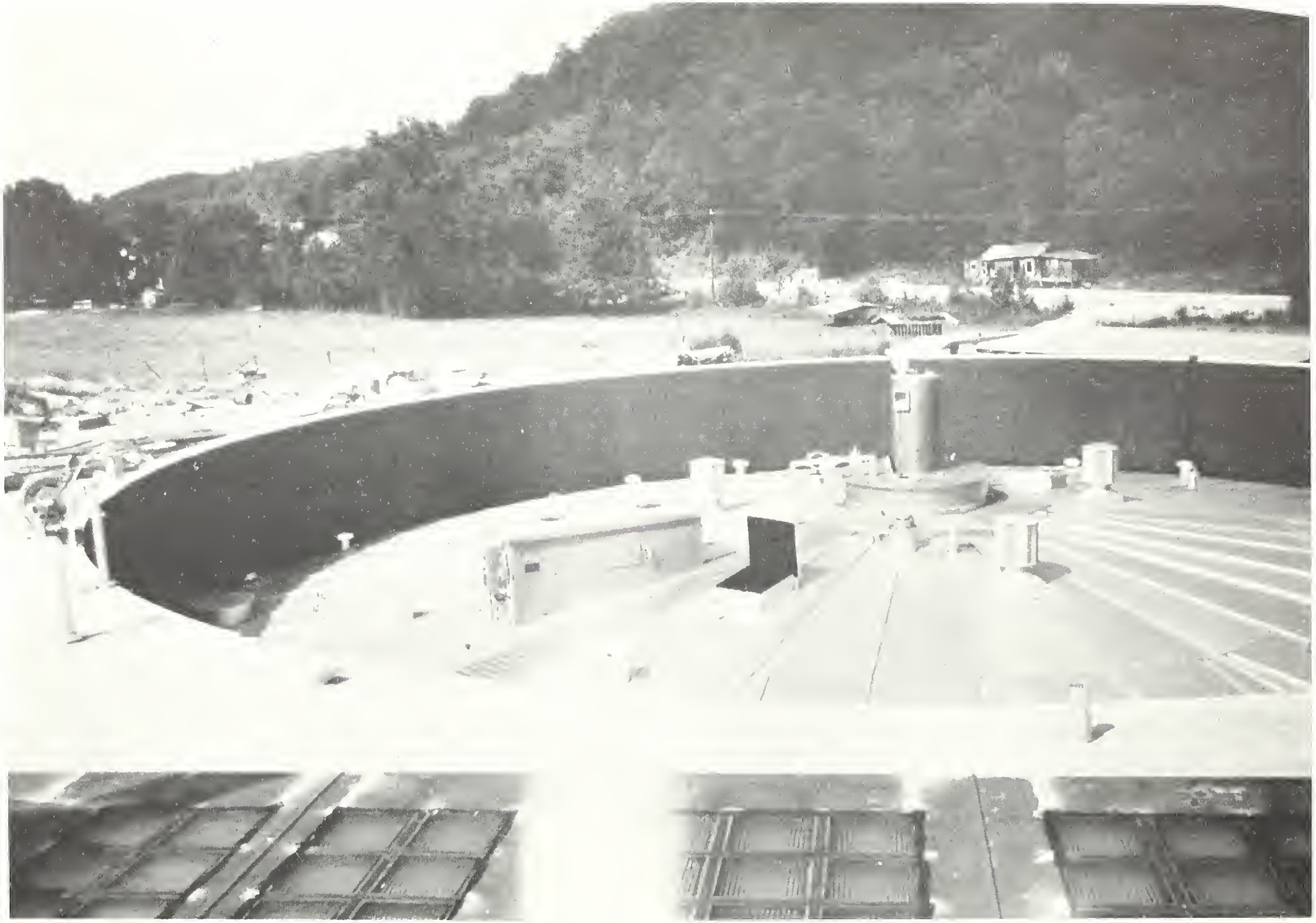


Figure 7

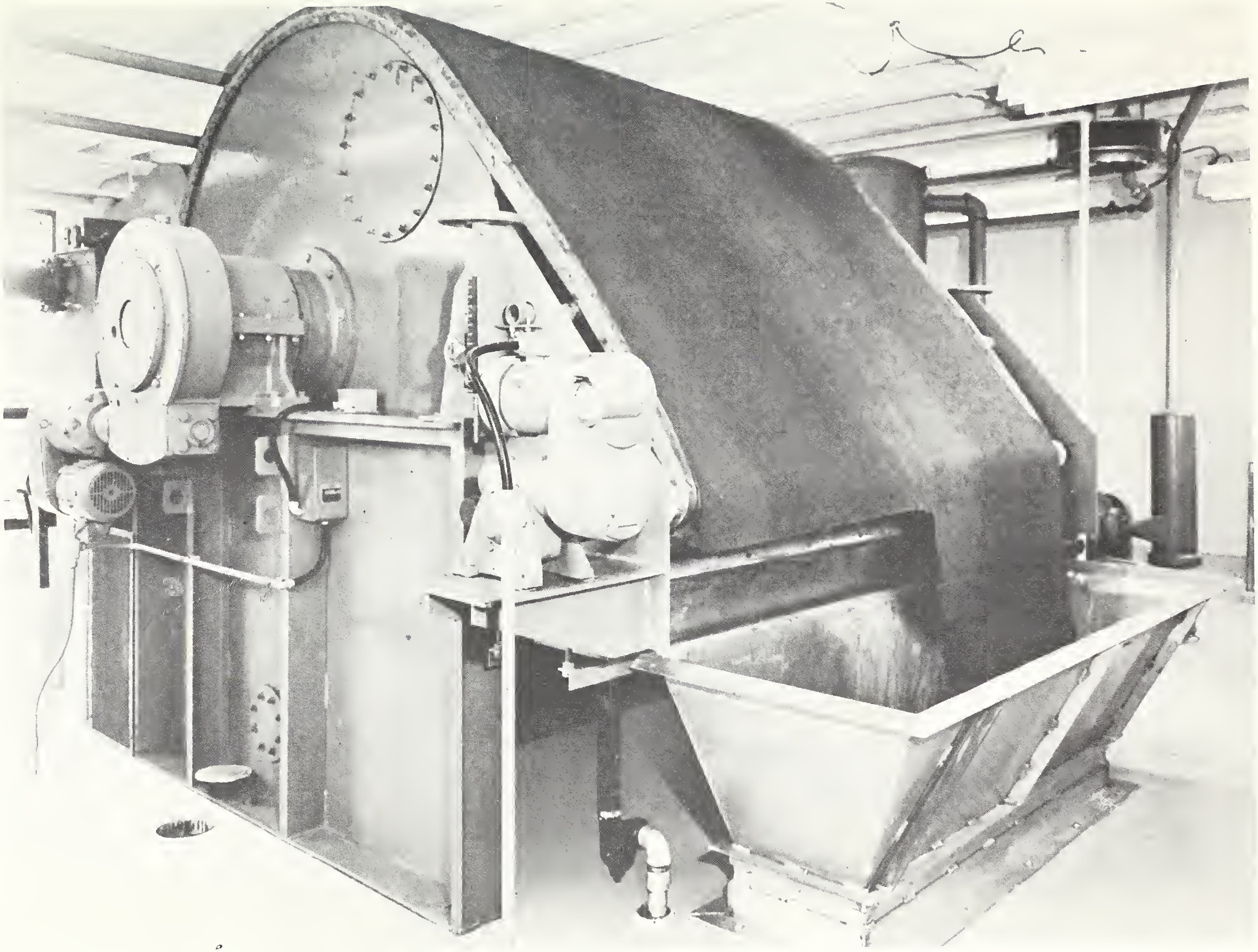


Figure 8

AEROBIC BIOLOGICAL TREATMENT

James J. Davies
Dow Chemical Co.
Baton Rouge, La.

Water pollution control does not return any profit to industry. When expenditures are necessary they must be made on the most economical and efficient long-term solution. No industry can afford to rework a waste water plant within only a few years of construction. It would be nice if there were a universal, off-the-shelf, packaged solution. In reality, each plant must be considered individually.

A study of the problems by the consulting engineer or the plant staff is a must. They should take into account the industrial process, the characteristics of the waste, the flow, byproduct possibilities, the receiving stream, prior art, and the site. Once the problem has been defined, a treatment process, or combination of processes, can then be selected.

Aerobic biological treatment is one of these processes. It is an engineered acceleration of the natural purification which occurs in streams, lakes, and rivers. Rock trickling filters, activated sludge, and the many modifications of both, are aerobic biological treatment processes.

Aerobic biological treatment is accomplished by contacting the organic component of waste water (carbon, oxygen, hydrogen, sulfur, and nitrogen compounds) with large quantities of bacteria. The bacteria, in the presence of oxygen, biologically convert these compounds to carbon dioxide, water, sulfates, and nitrates. In this conversion, the initial bacteria "seed" multiplies as it feeds on the organic waste.

One aerobic biological treatment system which has been developed to a high state of performance is the use of SURFPAC ® biological oxidation media in trickling filters. It provides an efficient, economical facility that would be a credit to any city or industry. Basic design parameters are available for many types of waste. These have been developed through years of continuing research and discussion with pollutors, consulting engineers and trade associations from Coast to Coast.

SURFPAC ® media has been installed in over 40 oxidation towers, some requiring over a half million cubic feet of media. In addition we have obtained data from over 120 pilot plant scale waste treatment operations. All of this data, where customer release was granted, have been put into a computer system as an aid to consulting engineers and customers who have problems or questions regarding the use of plastic media for secondary treatment.

As an example of the kind of economies offered by SURFPAC ® media, table 1 shows a comparison with conventional rock trickling filters at Cedar Rapids, Iowa. The difference is $269,000 *plus* 7.8 acres of land.

Table 1.—Economic evaluation of rock media and plastic media

Item	Rock media	Plastic media
New units required	14	2
Size of units (diameter) in feet	135	122
Depth of media, in feet	6	21
Volume of media, cubic feet	1,219,000	506,000
Design loading (lb. per 1,000 c.f.)	50	157
Percent removal design	66	61
Percent removal anticipated	66	78[1]
Minimum land area required, acres	8.7	0.9
Total cost (excluding land)	$1,846,000	$1,577,000

[1] Approximately.

Pilot plant data indicate SURFPAC® can make a contribution to the control of water pollution in the vegetable processing industry.

Table 2 shows data obtained with fruit canning wastes during a study conducted in cooperation with the National Canners Association Research Laboratories. Note the BOD removal rates that are obtained by varying the flow of raw waste and the recycle of treated waste. In the last instance, supplemental nutrients were added to promote a healthy bacteria growth. The recycling of treated waste increases removals, but can also serve another function. During periods of low flow, the recycled flow serves to keep the bacteria on the surface of the media moist.

Table 2.—SURFPAC® biological oxidation media of liquid fruit canning waste[1]

Flow		Biochemical oxygen demand				
Raw	Recycle	Influent	Effluent	Loading	Removal	Removal
G.p.m.	*G.p.m.*	*Mg./1.*	*Mg./1.*	*Lb./1,000 ft.³/day*	*Lb./1,000 ft.³/day*	*Pct.*
0.14	2.0	4,033	580	316	273	86
.42	2.0	3,200	1,395	730	410	56
1.0	1.0	3,210	2,040	1,760	630	36
1.0	1.0	2,750	1,515	1,510	680	45[2]

System outline: Standard pilot plant (153 $ft.^3$ of media packed to 21.6-foot depth).

Waste description: Liquid fruit canning waste from the processing of peaches and pears. Lye peeling waste included. Fruit hydraulically conveyed. Influent and effluent samples settled for 15 minutes before analysis. Raw waste pH 10.5. Effluent 6.2.

[1] Program conducted by the National Canners Association.

[2] Supplemental nutrients added.

Table 3 shows the results of using SURFPAC® to rough treat beet sugar waste. Again, removal rates depend on flows. The temperature differential between the influent and the effluent is significant. In one instance, an oxidation tower packed with SURFPAC® is also being used as a cooling tower. Two blowers provide additional draft.

Table 3.—SURFPAC® biological oxidation media to rough treat beet sugar waste

	Days	Biochemical Oxygen Demand					Temperature	
Flow	sampled	Influent	Effluent	Loading	Removal	Reduction	Influent	Effluent
G.p.m.	*Number*	*Mg./1.*	*Mg./1.*	*Lb./1,000 ft.³/day*	*Lb./1,000 ft.³/day*	*Pct.*	*°C.*	*°C.*
7	7	428	201	235	125	53	37	26
14	8	359	247	395	123	31	37	28

System outline: Standard pilot plant (153 $ft.^3$ of media).

Waste description: Total plant waste, unclarified, except for 15-mesh screen to remove pieces of plants. All samples were laboratory settled to simulate planned operation at a new plant site where the raw waste will be clarified.

Table 4 shows roughing of citrus waste. Note the difference in BOD reduction rates between settled and unsettled effluent.

Some examples of installations are shown in the accompanying photographs.

Table 4.—SURFPAC® biological oxidation media to rough treat citrus waste

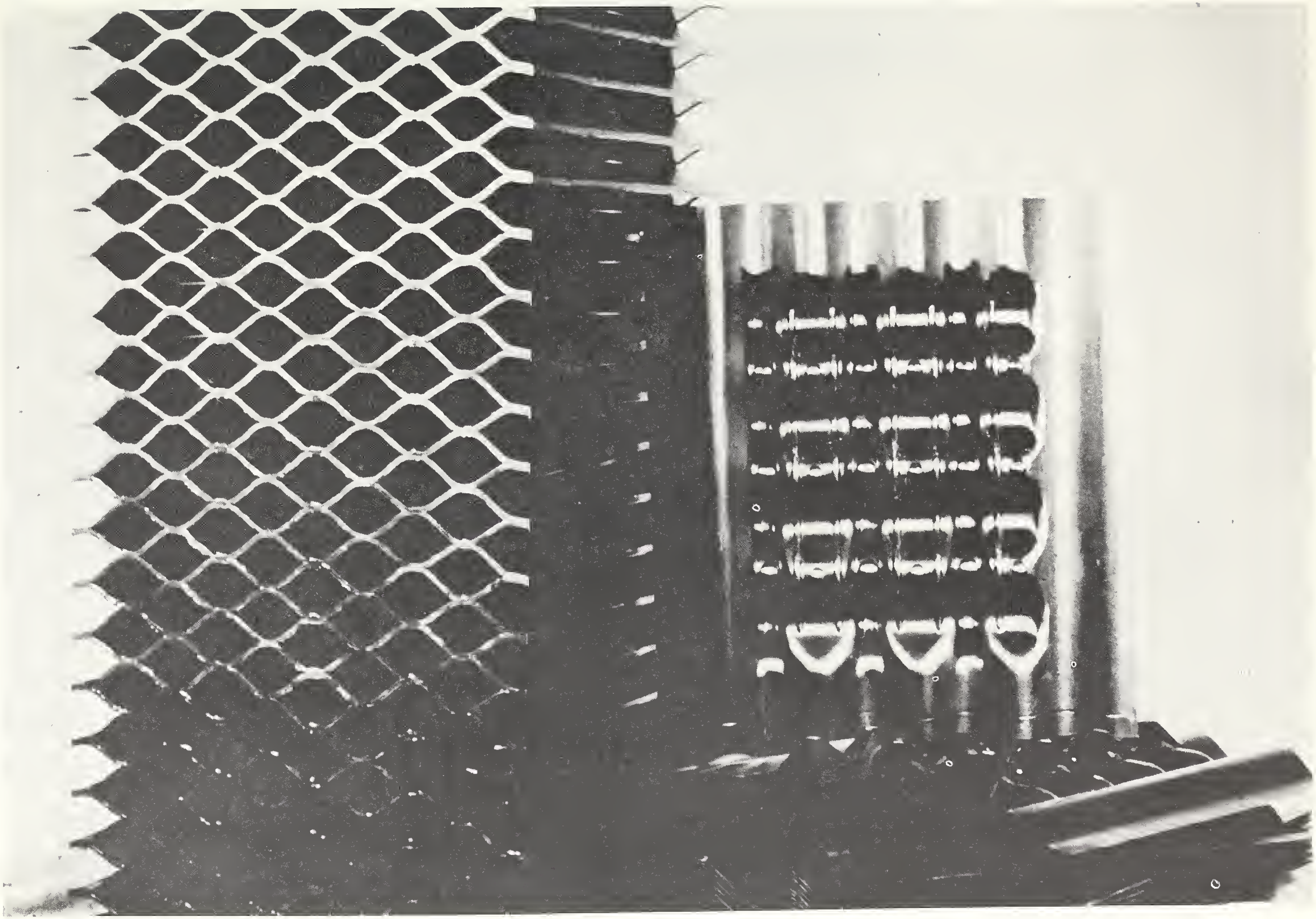
Biological Oxygen Demand									
Raw	Recycle	Influent	Effluent	Settled effluent	Applied	Removed	Removed with settling	As is	Settled
G.p.m.		*Mg/l.*	*Mg./l.*	*Mg./l.*		*Lb./1,000 ft.³/day*		Pct.	*Pct.*
2	6	542	242	170	199	110	137	55	69
7	14	464	324	268	612	184	257	30	42

System outline: Standard pilot plant (153 ft.³ packed to 21.6 ft. depth).

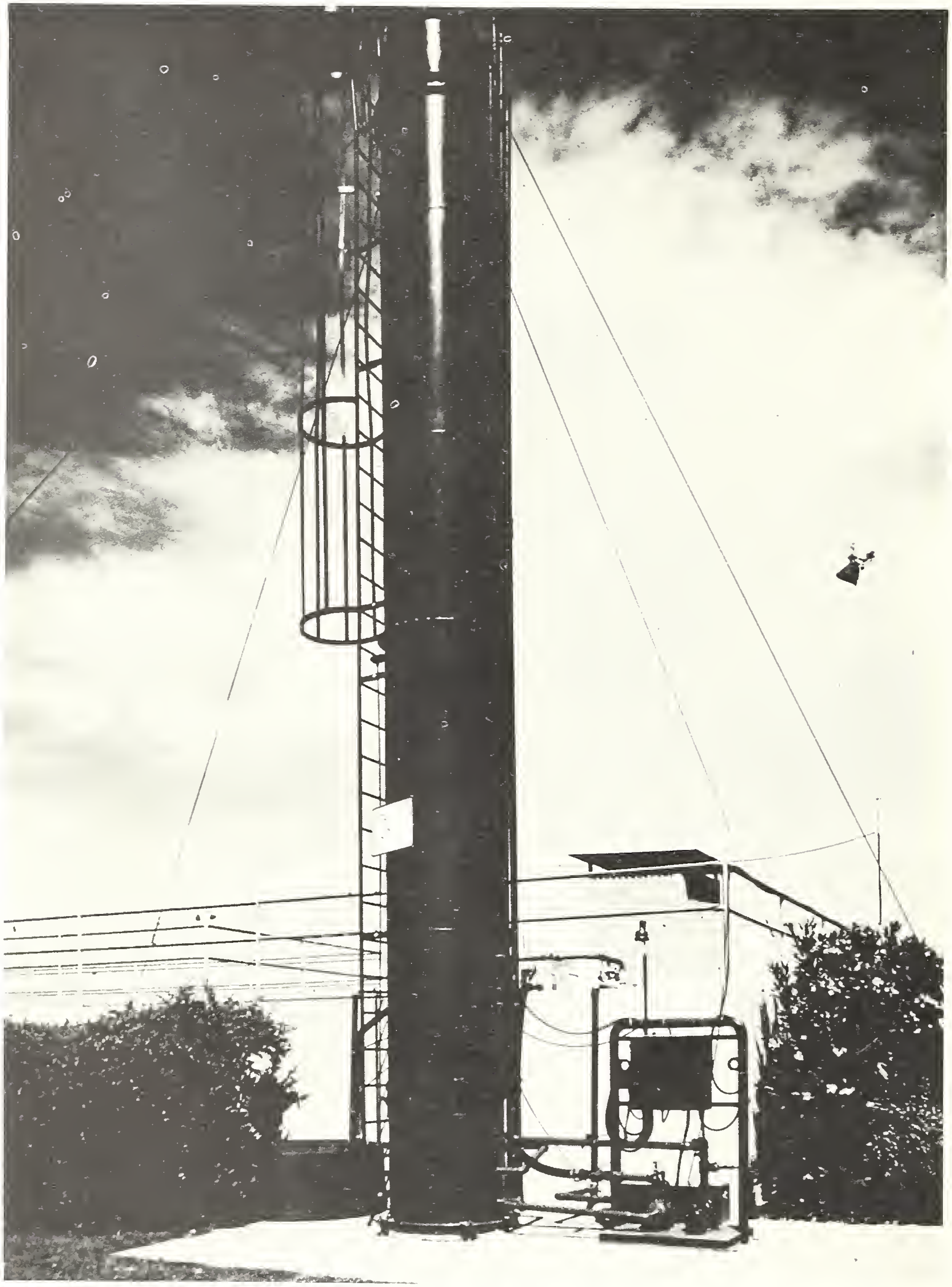
Waste description: Raw citrus waste screened through 40 mesh screen. Includes general plant clean-up and process wastes.

In summary, then, for an aerobic biological treatment facility, one needs a maximum number of bacteria, an efficient aeration system, and excellent waste per bacteria contact.

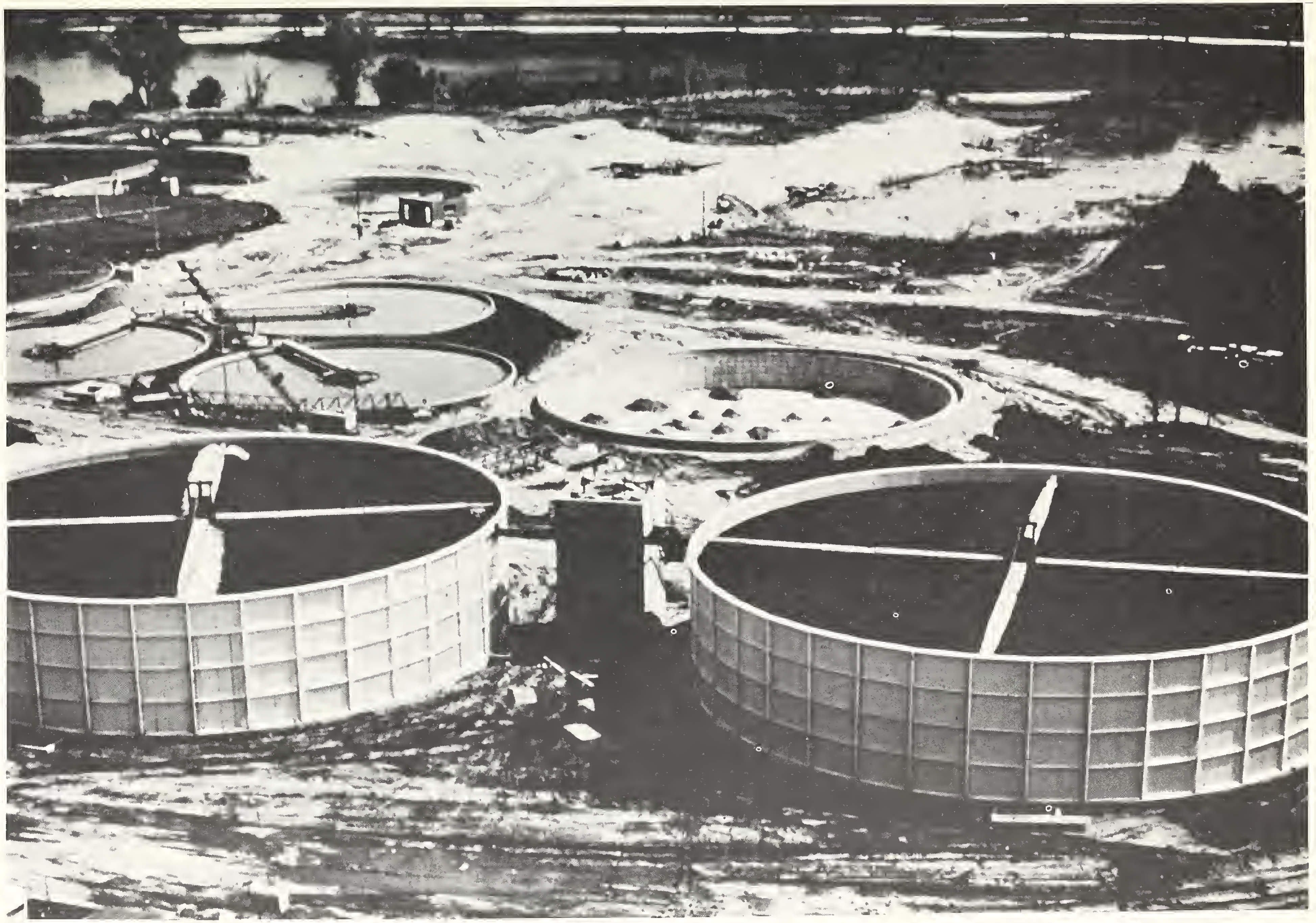
We know SURFPAC® can offer this as well as versatility of design, simple construction, ease of operation, quick recovery from shock loads, and uniform high degree of treatment.



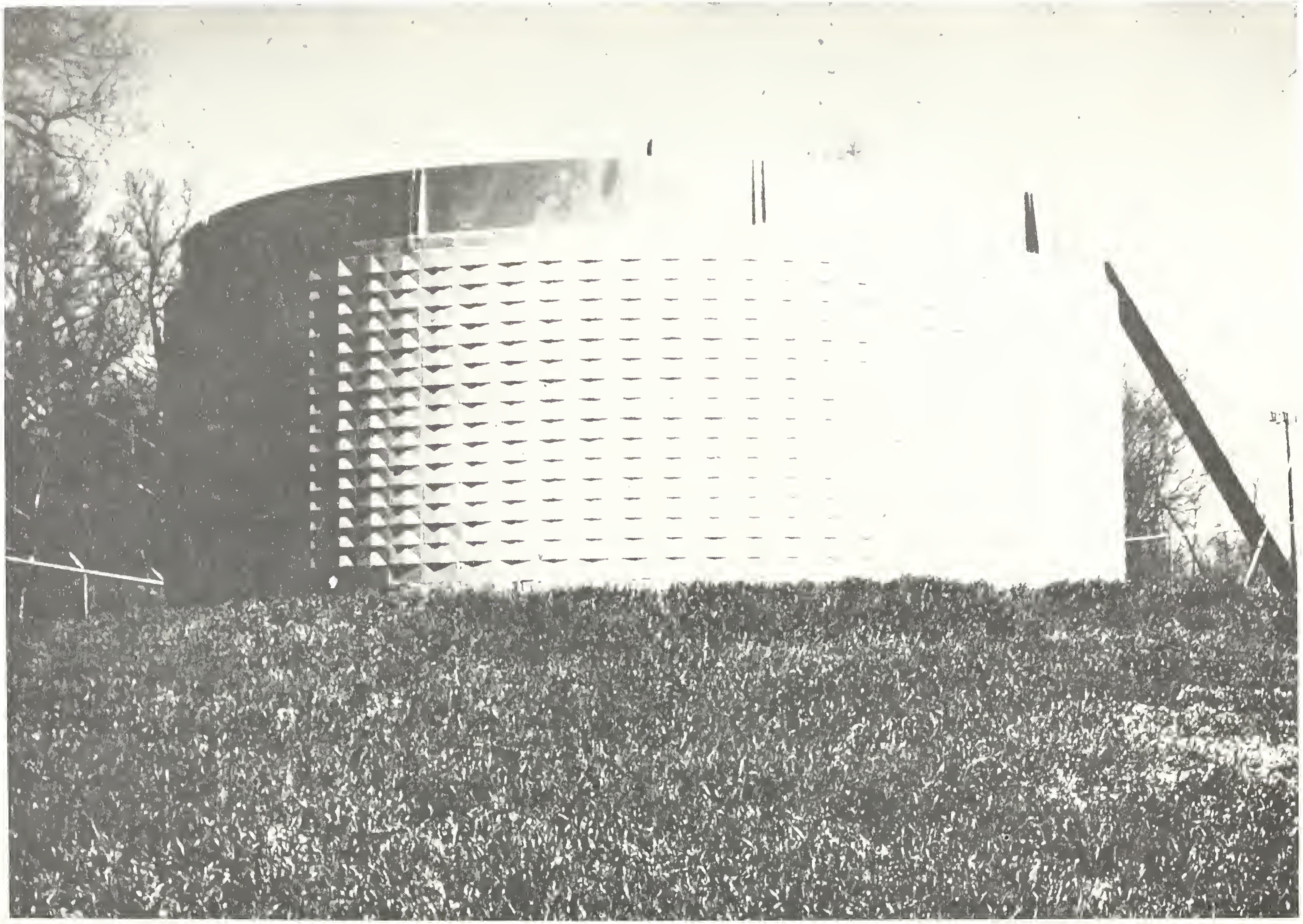
Modules of SURFPAC® media provide a maximum of void space and surface area of efficiently place the waste in contact with bacteria in the presence of oxygen.



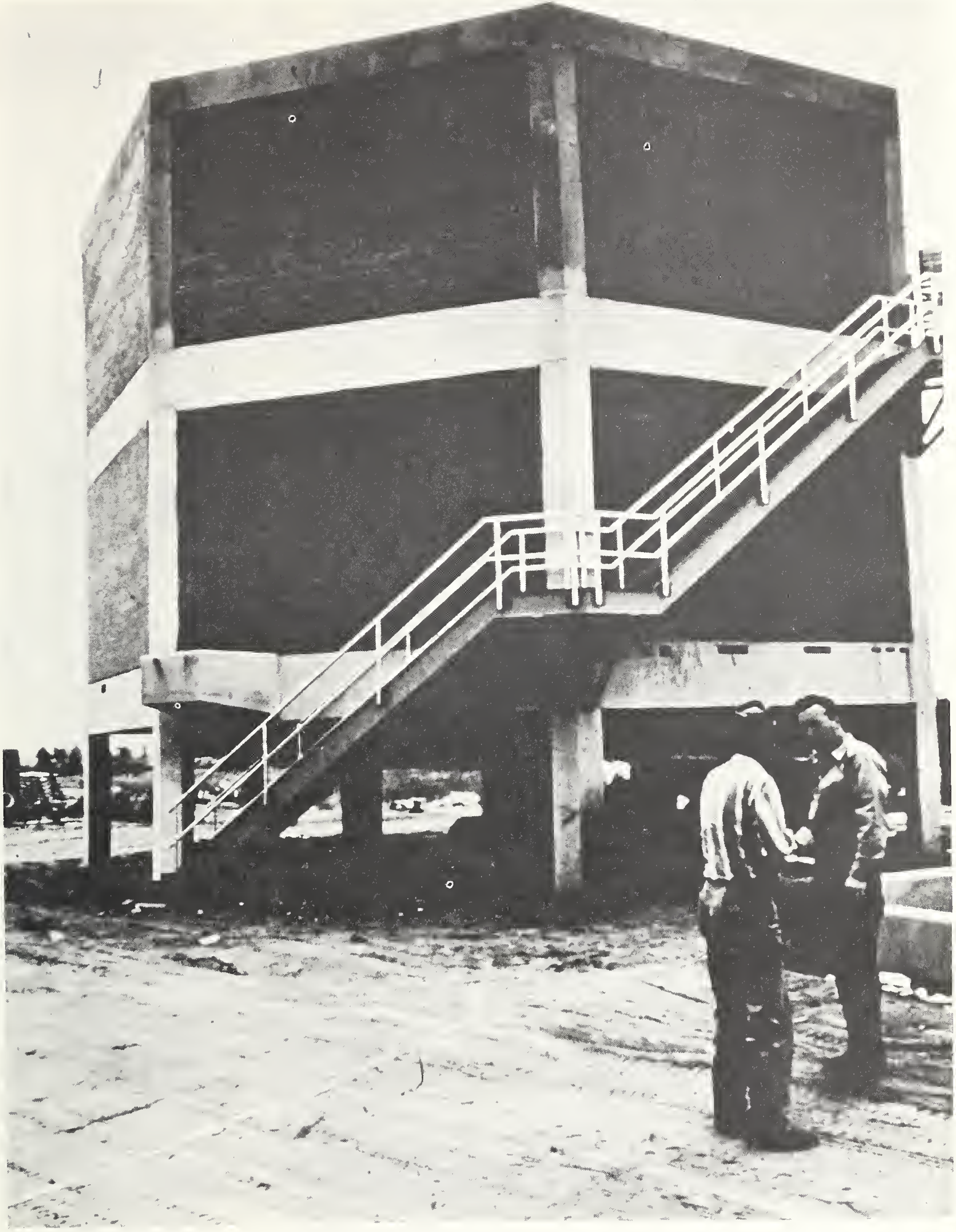
Pilot plant for determining the efficiency of SURFPAC® media in treating various wastes.



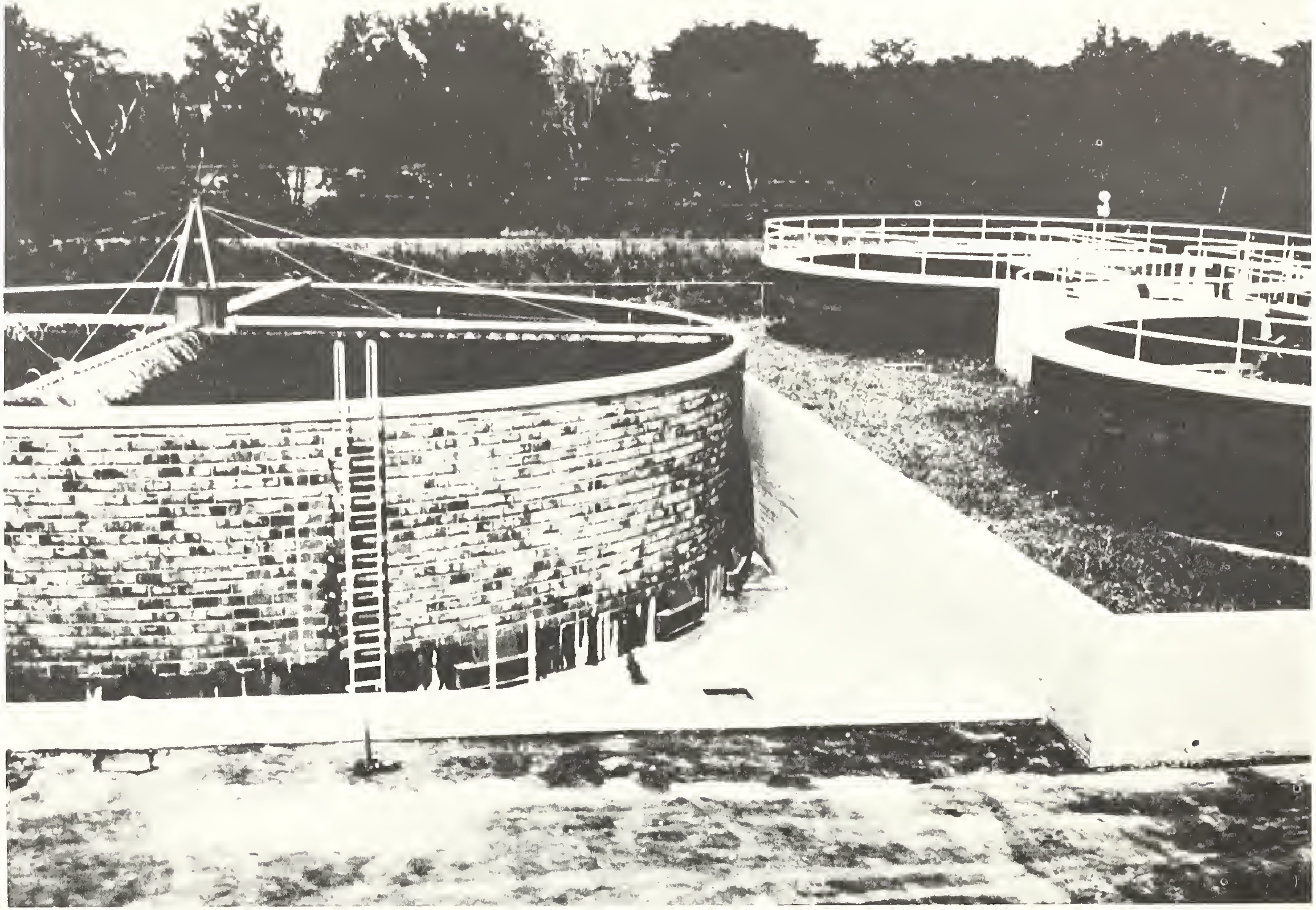
Two trickling filters in use at Cedar Rapids, Iowa. Each is 120' in diameter, 21.5' deep, and holds 252,000 cubic feet of SURFPAC® media. They pretreat 25 million gallons a day, reducing the BOD from 370 p.p.m. The loading is 150 pounds of BOD per 1,000 cubic feet per day. The units were chosen over the alternative of 14 rock filters, each 130′ in diameter.



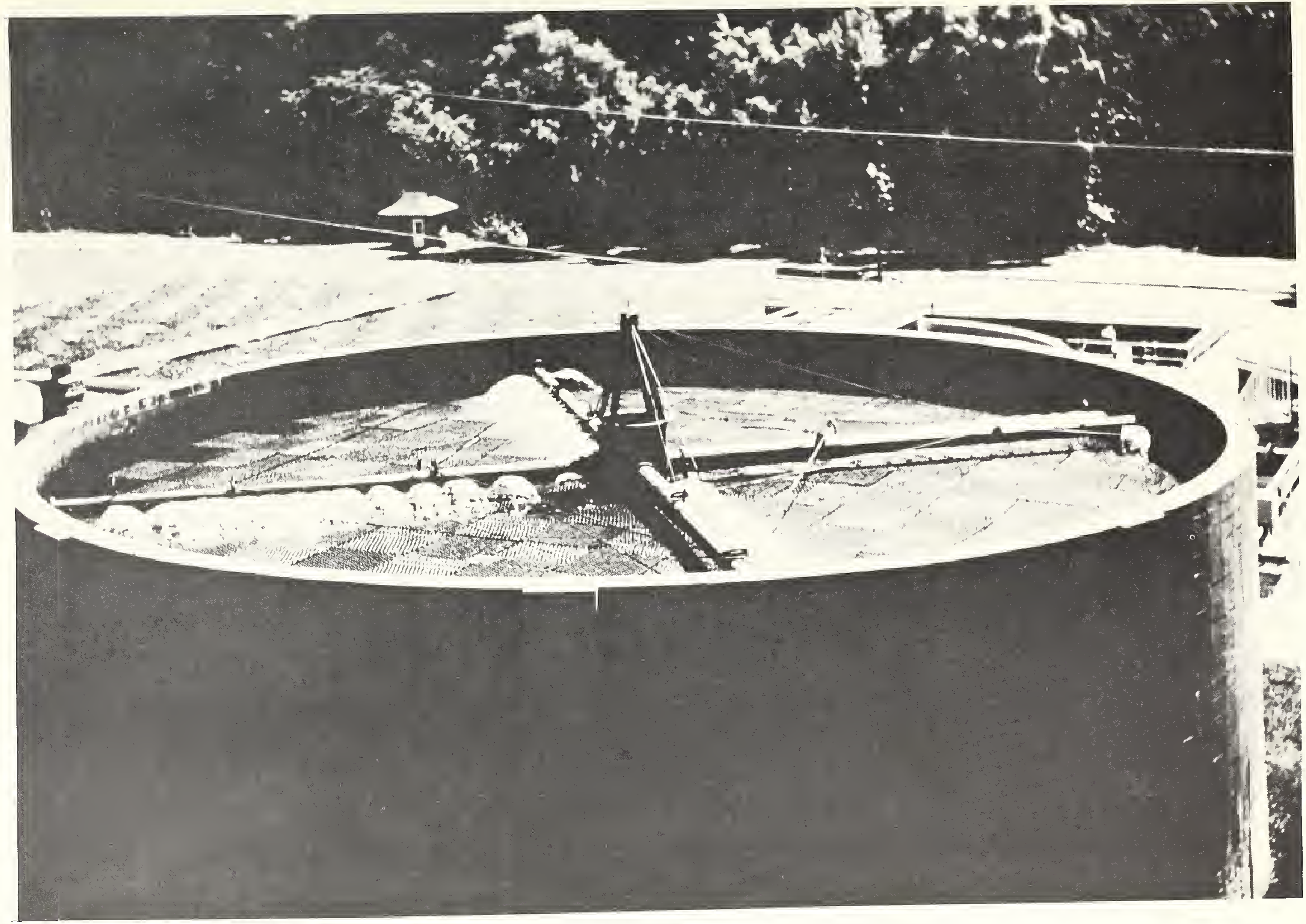
By using SURFPAC® media, expansion capability was built in to this unit. Another 10' of media can be added removing the retainer ring and adjusting the rotary distributor. This unit is fed screened raw sewage. The existing primary clarifiers were made into final clarifiers to expand the plant.



SURFPAC® is used in this unit to pretreat brewery and domestic waste. It was built on stilts to provide gravity flow through the rest of the plant.



This and another unit at Sedalia, Mo., are used for complete treatment of domestic and food processing waste. Ninety percent BOD removal is being obtained.



This oxidation tower using SURFPAC® media at Hershey Estates, Pa., treats domestic and candy waste. Note the simple concrete block construction and the even, high-rate distribution of waste.

PILOT PLANT STUDIES

In addition to full-scale operating units, extensive pilot plant studies have been conducted on various wastes including industrial, domestic, and various combinations thereof. Industrial wastes have included fruit canning, citrus, paper mill, chemical, slaughterhouse, textile, sugar beets, pickle processing and corn milling. Some of the data obtained from pilot plant studies on vegetable processing and related wastes are included below:

SURFPAC®
Biological Oxidation Media
Potato Processing Plant Waste

	Biological Oxygen Demand		*Chemical Oxygen Demand*	
Depth of media (ft.)	21.5	21.5	21.5	21.5
Hydraulic rate (raw), g.p.m./ft^2	0.72	0.72	0.72	0.3
Hydraulic rate (total), g.p.m./ft^2	2.72	2.72	2.72	2.3
Applied BOD mg./1.	2,140	2,140	2,840	2,432
Effluent BOD mg./1.	[1]877	[2]640	773	560
Loading, lb. BOD/1000 ft.^{3}	840	840	1,100	530
BOD removal, percent	59	70	72	77

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[1] Not settled.

[2] Estimated settled effluent.

Notes:

1. Effluent DO: About 3.0 mg./1.
2. Temperature of wastewater—average 67° F.

System Outline: Standard Pilot Plant (153 cubic ft. packed to 21.6 ft. depth). Pilot study was 4 months.

Waste Description: Primary treated process water—including lye peeling, potato processing, potato starch.

SURFPAC®
Biological oxidation media
(System outline: Standard Pilot Plant—153 ft.^{3} of media packed to 21.6-foot depth)

Flow		Biochemical oxygen demand		
Raw	Recycle	Loading	Removal	Reduction
G.p.m.	*G.p.m.*	*Lb./1,000 ft.^{3}/day*	*Lb./1,000 ft.^{3}/day*	*Percent*
		Apples, apricots, and carrot processing plant waste[1]		
1.50	1.00	165	76.7	46.5
		Sweetpotato processing plant waste		
1.50	.50	481	252	52.3

[1] Nutrients added.

SURFPAC®
Biological oxidation media
(System outline: Standard Pilot Plant—153 ft.^{3} of media
packed to 21.6-foot depth)

Flow		Average biochemical oxygen demand		Biochemical oxygen demand		
Raw	Recycle	Influent	Settled effluent	Loading	Removal	Removal
G.p.m.	*G.p.m.*	*Mg./l.*	*Mg./l.*	*Lb./1,000 ft.^{3}/day*	*Lb./1,000 ft.^{3}/day*	*Percent*
		Corn wet milling waste [1]				
0.5	0.5	1,950	624	540	365	68
1.0	.5	2,095	1,403	1.060	390	33
		Pickle processing plant waste [2]				
2	10.5	1,330	710	209	96	46

[1] Complete plant waste from wet milling of corn for starch and lactose production.

[2] General waste from processing plant to produce canned pickles. Acetic acid, lactic acid, and carbohydrates made up the major waste constituents.

DISCUSSION

QUESTION: What is the extent of the use of the towers, particularly on fruit and vegetable cannery waste? What is the backlog of experience? I gathered from the discussion that this has been primarily in the area of some particular types of waste, but I did not get the impression that this had yet been applied to fruit and vegetable cannery waste. What is the status on this?

MR. DAVIES: We have applied several fruit and vegetable wastes to our SURFPAC® pilot plant to determine the biological treatability of the various wastes. I brought several tables of data obtained from the studies, which are exhibited on the table at the back of this room. As a result of favorable economies, several full-scale oxidation towers have been erected and are in operation.

QUESTION: These are canneries for fruit?

MR. DAVIES: Many were for fruit wastes. I believe Dr. Mercer would have additional information on the treatment of these wastes in a plastic media oxidation tower.

QUESTION: Can this filter media be used in the area of slow sand filtration processes where a low flow rate would be required, or is this purely a rapid filtering process?

MR. DAVIES: The so-called *trickling filter process* that applies to a plastic media tower is quite different than the *sand filtration process* where finely suspended solids are removed. For example, the minimum hydraulic application rate to a SURFPAC® oxidation tower we suggest is 47 m.g.d. This compares to an average hydraulic application rate of 3.5 m.g.d. for a standard rate rock trickling filter, and 20 m.g.d. for a standard rate rock trickling filter, and 20 m.g.d. for a high rate rock filter. The 47 m.g.d. is about 0.7 g.p.m./ft.^{2}, that is, the fluid application rate to the top surface of the filter. The average hydraulic application rate to a SURFPAC® tower is about 2.0 g.p.m./ft.

A SURFPAC® module will have a surface area of 27 square feet per cubic foot of packing and have 94 percent void space. This void space allows for a large flow of fluid and an equally large volume of air to pass through the filter and thus furnish oxygen to oxidize the organics in the waste water.

COMMENT: This would be your trick.

MR. DAVIES: Right. Also, if the waste stream has a high organic load, that is, where the biological oxygen demand (BOD) is quite high or is hard to treat biologically, recycling part of the filter effluent over the media will generally result in a greater BOD reduction. It is not uncommon to obtain greater than 90 percent BOD reduction of plant effluent through a SURFPAC® oxidation tower waste treatment plant.

QUESTION: Does this media depend on the surface area? In other words, do you have a maximum surface area? Within small particles is it smooth or is it rough, shall we say?

MR. DAVIES: You are asking about the surface area of the media?

QUESTIONER: In a portion of the module, shall we say.

MR. DAVIES: The surface area in a *SURFPAC*® module is 27 square feet per cubic foot of media. The module has a void space of 94 percent. Most of the surface is vertical. However, there is just enough lateral surface to prevent free fall of fluid. Thus, all fluid entering the tower comes in contact with bios adhering to the SURFPAC® surface where the organics in the waste water can be biologically reduced.

QUESTION: What preparation of the waste water is necessary before the tower? What breaks down the waste size?

MR. DAVIES: You're asking the degree of solids removal required before using the tower?

QUESTIONER: Right.

MR. DAVIES: Rags, paper, and other such bulky materials must be removed before using the tower to prevent the possibility of the unit plugging up. There is approximately 1 inch between the plastic sheets in a *SURFPAC*® module.

In Dayton, Ohio, screened raw sewage has been applied to a SURFPAC® tower with success. This tower is removing 60 percent of the influent BOD. Generally, however, the units are preceded by a primary clarifier to remove settleable solids.

In an extreme example, a SURFPAC® oxidation tower has succeeded as an aerobic digester by aerobically reducing BOD in a 3-percent sludge stream.

Gerald O'Connor
Monsanto—Biodize
College Point, N. Y.

(No copy of this paper available for publication.)

Arthur J. Freedman
Nalco Chemical Co.
Research Laboratory
Chicago, Ill.

As the last speaker on this panel, I should like to emphasize Nalco's specific plant survey approach to solving industrial waste treatment problems. Each of the approaches outlined by our other speakers today is valid and has performed very well in many individual plants. However, I rather suspect that some of you in the audience have listened to these proposals and thought to yourselves, "No, that won't work for me because. . ." The point is, that each cannery is unique in terms of the specific materials processed, the quality and quantity of water available for processing use, the amount of land available for use in waste treatment, the specific streams, lakes, or municipal systems available for carrying away wastewater, applicable State and Federal standards, possibilities for utilization of byproducts, and so forth. All of these things are different for each plant.

We at Nalco feel that we are experts in water treatment. We know a great deal about water: How to prepare it for specific municipal and industrial needs, and how to treat it for proper disposal after use. We are also experts in industrial process operations. We would like to bring these two technologies —our knowledge of water and our knowledge of industrial operations—into your plant, and work with you to solve your specific waste treatment problems.

As some of our speakers so aptly pointed out this morning and again this afternoon, everything that you do to control pollution is going to cost money, and you would like to do as much of this for yourselves as possible. This is certainly valid, and Nalco's approach is to help you help yourselves. Working with your own plant people, we would like to survey your entire plant to find each waste water stream. Where does it come from? How much of it is there? What is its composition? Most important, does it need to be there? Often, by slightly revising a process operation, it is possible to eliminate or greatly reduce the amount of water discharged from that operation. Let's reuse as much water as possible. If it can't be used again for the same application, let's search for other in-plant uses where water of that quality will be applicable. These are things that you already know: but, again, as one of the speakers of our present panel pointed out, no plant really recognizes its own problems. The old saying about the forest and the trees is very applicable. It is helpful to have an outsider who is impartial and objective, help you examine your own plant from this point of view.

Very often, a plant survey of the type I have been discussing will uncover opportunities for segregating wastes. As you all know, small amounts of concentrated wastes are much easier to treat than large volumes of dilute waste water. Many times, in the canning industry, as much as 90 percent of the total effluent BOD may be contained in 10 percent of the waste water. In many plants, this provides an opportunity for specialized waste treatment, often resulting in a salable byproduct. Canneries use large amounts of caustic for peeling, and some plants have found that by recovering and recycling their caustic, they can solve a difficult waste treatment problem and save money besides.

Eventually, of course, some residual waste water remains to be treated. It then becomes important to choose the best approach. It may be a biological system; it may be coagulation; it may be something else. By working with you in your plants in this way, Nalco would like to help you identify your problems and find your optimum solutions.

SESSION III: Donald W. Newsom, Department of Horticulture, LSU, Baton Rouge, La., Chairman

PANEL: "Research and Development Needed"

Kenneth G. Weckel
University of Wisconsin
Madison, Wis.

I have discovered that apparently two kinds of bulletins have been distributed to the audience. They both happen to be colored red, but only one of them deals with cannery waste. You may have gotten one that deals with an entirely different subject, sauces for canned vegetables. How the error occurred I do not know. If you did not get the one entitled "Vegetable Canning Process Wastes," which is the title of University of Wisconsin, College of Agriculture and Life Sciences, Research Report No. 38, please request a copy from Mrs. Saucier to whom I shall send a number of copies. She will mail them to you. It contains much information on the origin and magnitude of wastes in vegetable canneries.

An interesting fact in vegetable processing is that out of 100 pounds of fresh peas, there will be a yield of 87 to 93 pounds of peas after blanching, which is equivalent to a loss of 7 to 13 pounds of solids in the form of water solubles in the blancher. I am convinced there is much unnecessary blanching in processing certain vegetables through blanchers. We do not have a good "end point" in the blanching of vegetables. Vegetables are usually blanched sufficiently to assure a clear brine in the final product. Our intention is to obtain a clear brine, but I think few of us are blanching just sufficiently for that purpose. We thus have two effects: One is we are actually losing a lot of weight unnecessarily in terms of yield of the product; secondly, we are creating, unnecessarily, wasteload for pollution. If you multiply this out for all the tons of peas, beans, or other vegetables that are processed, then it can be seen this can mean a very sizable waste load. I think it would be well for us to investigate our blanching processes. We found in our studies that blanching whole kernel corn to remove air could be reduced or eliminated by vacuum packing the corn. By eliminating the necessity of blanching whole kernel corn, a reduction in effluent wasteload was possible in the form of soluble solids and suspended solids.

These then are areas about which we ought to have more information to reduce both our waste losses within the plants and treatment of wastes from the plants.

There are other methods of blanching besides water blanching. Steam blanching has never come into general acceptance for canning for various reasons. Hot air blanching and fluidized blanching should be further investigated for vegetable processes in terms of waste losses. We should investigate the blanching of vegetables in media with osmotic pressures similar to those of the vegetables.

We need to know more about the role of screening for separation of discrete and suspended solid material from cannery wastes. During the past year, we have investigated several screening systems on a pilot scale in different plants in an attempt to determine the efficiency of screening, using different types of meshes. We have been surprised to learn screening does not always reduce the BOD of the waste discharge from the screening process. With corn, there was actually an increase in the apparent BOD value of the waste from the screen. This was confirmed by other Laboratories. It is believed there is some fragmentation of colloidal corn particles which increases the activity in the 5-day BOD test, and results in an apparently greater BOD value. We concluded from these studies that we ought to know more about actual particle size and the molecular nature of these colloidal particles to better understand how to effectively screen and treat the material that is separated.

A further point that I might touch upon to which you may well give some thought is the relative degree of the leaching of solids from crops with different stages of maturity at harvest. As you know, the sugar content, the starch content, or the total solids content of various crops increases as they mature. Thus, there can occur different amounts of "extracts" as solubles or suspended solids during their processing. This became apparent to us during the past several years in studies on the relative peak of maturity at which vegetables should be harvested. We found that there is considerable range in composition of vegetables such as peas, beans, or beets of the same size harvested at different stages of maturity. Consequently, the relative amount of extracted material from such products varies considerably. In terms of the relative load of the product being processed through the plant, such as 10 tons per hour, variations in composition percentagewise would be considerable in terms of the net waste load.

Another area in which we need much more effective control is in the use of water in the processing plant. This was referred to by two previous speakers who mentioned the quantities of water being used in their plants, relating to gallons of water used during the day, or used per hour. It has been my experience in meeting with cannery managers that very few of them really know how much water is being used at various places within the plants. They may know the total amount of water used, but few where it is used and how.

Water is relatively one of the least expensive of the commodities per se we have in the plant to use. In terms of its ultimate effects in the total problem of waste disposal, it is very costly. One of the most effective ways of reducing the total waste treatment cost is by reducing or eliminating the unnecessary utilization of water. It may be relatively easy to explain this to plant managers, but it is much more difficult to get this translated to the supervisor or workman in the plant who can control the valves. Somehow we are not reaching the keymen in the plants who can actually regulate the valves and getting them to understand why control of water use is important in wasteloads. One of the best tools to translate this is to relate water use to the cost of fuel in the plant.

A critical effort was made in a cannery recently to reduce water usage to a level of 50 percent of what they had been using. It was discovered that in reducing water usage they were able to decrease their fuel costs a very significant percentage. In other words, the wasting of water was resulting in the wasting of tremendous quantities of heat, costing real money. So I would suggest you consider water use conservation as an avenue of importance because of other benefits from it.

It has become apparent to me in discussing wastes with the personnel within vegetable canning plants that very few of the key men know what you're talking about in waste management control. The men in the plant do not understand biological oxygen demand (BOD), and chemical oxygen demand (COD), suspended solids or soluble solids. They have had no instruction in waste characterization, yet they are the very people who could be effective in reducing the wasteloads in the plant, including spillage, waste recovery and water usage. In Wisconsin recently, we had a 2-day conference for some 200 key personnel from the vegetable canning plants throughout the state. The meeting included demonstrations of the laboratory procedures used to measure BOD, soluble and suspended solids, pH and so forth. Discussion was presented to where wastes originate in canneries and how these can better be controlled, and of methods and problems of waste treatment.

A problem which needs study is that of losses caused by mechanical failure. In the milk business, when a hundred pounds of milk is brought into the plant, theoretically there should be a hundred pounds of product in one form or another. If the yield is less, there is either spillage or stickage. In vegetables canning this cannot be done. When a hundred pounds of corn is brought in, there is only a rule for probable yield of cut corn available for canning. How much corn is wasted when corn from the field is processed into the cans is not readily determined. Large quantities of wasted usable or edible material can be observed at various stages within the average canning plant, often caused by uncontrolled mechanical spillage. There is great need for improvement of design of equipment to minimize mechanical waste losses; and there is need for a higher level of incentive by managers to reduce these wastes because they are significant. Research Report No. 38 shows figures for certain operations indicating losses of peas at the fillers were equivalent to 1 percent of the product actually canned and in the warehouse. These were peas already washed, graded, inspected, and passed to the filler for canning. The losses of whole kernel corn at the filler were as much as 3 percent of the total pack of corn in the warehouse. I thus challenge you to do two things. One is to see whether you can actually cut use of water by 50 percent. It can be done if you have made no previous effort on this, as canners are telling me they are doing it. Secondly, I think you should reduce usable material product waste to a real minimum because this is costing real money. It has been already paid for as raw material, and for being partly processed, and as waste must cost more in its disposal.

I wish to comment on the matter of discrete waste utilization. Walter Mercer previously has indicated rather strongly that we must go in the direction of disposing of this waste in a profitable way. We need more study on what to do with these wastes to maximize their use and to at least generate some income which can help reduce the costs in their handling. In this connection, handling waste per se is one problem; the leaching (solubles and suspended matter) that comes from the waste is another. The hauling away of the peel and the vegetable waste for disposal costs money, or course, but is necessary to get it out of the process system; the leaching generated in handling the wastes within the plant area are a real problem because they become discharged into the total plant effluent waste and into the lagoon or other disposal system. Very few really understand the magnitude of the cost of treating or the magnitude of the wasteload of the leachings which are extracted because of the handling of the waste within the plant. For example, 70 percent of the corn brought into a plant as corn on the cob is returned as waste. In the mechanical handling of this waste, there is considerable amount of leaching of solubles. This is true in the handling of most vegetables, and I believe this is worthy of study to determine ways to minimize the effects.

May I transgress on what I'm sure some of the other panelists will point out—that for the plant manager we need some quick and dirty methods, if I may use that expression, of measuring the wastes generated within the plant. We need quick BOD or COD tests so the manager can have some day-to-day calculations of wasteload management. Computers are in use whereby wasteloads in previous intervals of operation in a plant, or several plants, can be quickly determined and evaluated. At present, information on the magnitude of some of the wastes generated in the plants cannot be computed as there is no quick way of measuring them. We are in need of quick methods for their measurement.

Roy F. Weston
Roy F. Weston, Inc.
West Chester, Pa.

In accordance with the program, I had expected to be the first participant on this panel. Therefore, my remarks were oriented accordingly. Although I am not first, I will proceed as though I were.

As the first speaker, I felt I had an obligation to provide an overview of the subject of research and development needs. Also, I had to be sure that I didn't steal the thunder of my colleagues that will be following.

I arbitrarily chose to think of three types of research and development needs.

The three different types of needs may be generally categorized as follows:

1. Problem definition and solution-oriented activities related to immediate or short-range problems of limited scope.
2. Investigations of general application to the industry to improve technology or reduce costs or both.
3. Fundamental technical, economic, and philosophical studies that could create drastic changes in the industry's mode of operation.

The first type would be that of solving an immediate specific pollution control problem such as that for a "cited" cannery. Such "applied" research and development would define the source, quantity, characteristics, mode of occurrence, and variability of pollutional materials from a single plant that is creating a specific pollution control problem. Under this type of research and development, alternative control, equalization and effluent treatment, and disposal methods are investigated and evaluated for the purpose of determining the most feasible and economical solution. The technical and financial feasibility of treatment in a municipal system also may be studied and evaluated as part of this type of program.

The second type of research and development activity is more generally applicable and of long range. It is the type of activity that may be highlighted by immediate (that is, Type 1) problem-solving research and development. The development of a new type screen, the determination of the applicability of a rotating biological contactor, and the feasibility of dry caustic peeling of potatoes are illustrations of this type of research and development.

The third type of research and development is broad-based, new in concept, and definitely long-range. Such activities, if successful, could make substantial and possibly dramatic changes in the ways of conducting your affairs.

I would like to philosophize, for a few minutes, on the kind of thinking that I believe is essential to solving our environmental pollution control problems.

From a pollution control viewpoint, you should have a single objective. This objective should be that of avoiding or preventing, at least cost, any adverse impact on the environment because of your activities of supplying vegetables to the ultimate consumer.

The above is a simple axiomatic but loaded statement. It raises questions as to "what aspects of the environment?" and "whose costs?" To answer these questions, it is necessary to do some more philosophizing.

How do you justify being in business? Your justification is that you provide a wanted product to society at a competitive cost. Society affords you the opportunity to make a profit as long as it is satisfied with the quality of your product and the magnitude of its costs. It would appear that those of us in the private enterprise system have both a practical and a moral obligation to provide our services to society at the lowest possible cost.

When we think of costs, we cannot think in terms of the over-the-counter price only but we must think in terms of the total costs to society. Thus, if society is burdened with current or deferred costs because of misuse of resources, pollution of the environment, or disposal costs that are not incorporated in the over-the-counter price of the product, society is being misled as to the worth of the product. Such an insidious situation provides an imbalance in our economic system and, therefore, is hazardous to all. Consequently, we must look at the complete system. In your case, this means looking at the system from soil preparation through planting, cultivating, growing, harvesting, processing, and packaging to ultimate use. We must look at the impact of these activities on our air, water, and land resources.

Your interests are primarily those of food processing. If you are to properly understand your role in the environmental protection scheme of things, you should know the impact of your activities relative to those of the other steps in the chain of events from soil preparation to ultimate use and disposal. I believe that original and imaginative solutions are possible only when the entire system and its inter-relationships are well understood.

Let us look at some of these inter-relationships. Land preparation, fertilization, and cultivation may influence the characteristics of runoff from rainfall and thereby influence water quality relative to suspended solids, turbidity, and nutrient concentrations. Poor land-use practices may create siltation and high turbidity problems. Fertilization practices may create nuisance biological growth problems in streams, lakes and reservoirs. The use of pesticides and herbicides may have serious adverse effects on aquatic life. Harvesting practices may prevent return of organic materials to the soil. This may influence the characteristics of runoff from rainfall. Processing may create problems of air pollution, ground and surface water pollution, and solid waste disposal. The seasonal and peak load characteristics of vegetable processing may create severe water pollution abatement problems for both direct discharge to natural waters or discharge through a public sewerage system. The types of packaging and the marketing methods employed may create solid waste disposal problems.

It is apparent that all steps in the system have an adverse effect on the environment. Changes in practice in one part of the system may influence environmental pollution by other parts of the system. Therefore, our interest should be that which minimizes pollution problems and costs for the entire system rather than for just an isolated part of the system. Only by looking at the entire system can we evaluate whether or not we are carrying our share of the load.

Earlier in the program, there was discussion relative to the difficulties encountered from discharging cannery waste waters to a municipal sewage treatment plant. The creation of such problems is unnecessary. Techniques are available today that make it a relatively simple task to predict the impact of a cannery waste water discharge on a municipal treatment facility. Therefore, it should be possible to predict the feasibility of treatment and the treatment capacity of a municipal system before receiving the cannery waste waters. In general, good performance and low cost should be expected from properly designed and operated combined cannery and municipal systems.

All three types of research and development are needed to evolve technically sound and economically feasible solutions to vegetable processing problems. It is believed that fundamental studies of the entire production system are essential to original, imaginative, and complete solutions to the complex problems of pollution of our environment.

W. W. Eckenfelder, Jr.
The University of Texas
Austin, Tex.

I will confine my comments to research needs relative to waste treatment. I'd like to start with a comment that the vegetable processing industry presents something of a paradox. On one hand, we have a very readily degradable waste and on the other hand while it is readily treated, it has a very high degradation rate in streams and natural waters. This is coupled with the fact that very often your maximum canning seasons coincide with the periods of minimum or lowest streamflow, thereby accentuating the problem.

Therefore, on this basis, we can reassert the ground rules that have been commented on in the papers and discussions earlier: (1) that economical land area is frequently available; (2) high variations seasonably may render conventional treatments, such as the activated sludge process, totally unsuitable or extremely difficult to operate; and (3) that combinations with domestic wastewater present problems for the same reasons I indicated in the second point; and (4) which again has been brought out frequently is that unless water reuse is practiced, high waste-water volumes will probably result. Therefore, this sets the pattern where possibly major research effort should be put.

The first point is water reuse and product recovery. I'll not spend any time on this because this has been amply emphasized by the other speakers, but it does come down to the development of cost-benefit curves of reuse and recovery versus treatment costs. This has been developed for a fairly large number of industries. I'm not familiar with any detailed studies on the cannery and vegetable processing however.

Two, an understanding of the design and performance criteria of the most economical processes that might be employed, such as lagoons and aerated lagoons, is essential.

Now, I emphasize this point since most of the waste treatment, from what I have seen in the canning industry—and this is pretty much true of many other industries—is what we call in the trade a belly-rub operation. If it doesn't function, you rub deeper. Well, this is poor engineering. I am convinced personally that many of the problems that have been discussed earlier could have been overcome or certainly minimized by initial application of good engineering and good understanding of the process principles as has been brought out earlier by Weston. You can't overemphasize this point.

In a way, what I am saying is that before we go to more costly and exotic processes perhaps we ought to understand the capability of what we have, since lagoons and treatments of this type, which are very common today, are going to continue to be very common in the canning industry because they are economical. We don't really understand the capabilities of these systems. I might add, I don't think we fully understand the capabilities of soil disposal, land disposal, spray irrigation, and the possibility of combining treatments with other treatments during periods of peak seasons. I might add that because of the seasonal nature of most canneries, a little more imagination on the part of engineers is needed to get the most economical answers all year round. For instance, there are possibilities that you can use an aerobic lagoon during the peak season and drop this back to an aerated or facultative pond during the rest of the year and still meet the regulatory requirements. There is a cost reduction involved by picking the proper type of equipment to give you the most economical operation.

My comments here were primarily aimed at taking a look at what is being done in the industry today in an attempt to find out how much it can do for us. I'm not implying that in many cases what is being done today will not meet present or future water quality criteria, but I think we ought to find this out before spending a great deal of money on treatment that may or may not be in fact needed.

Foymae West
Gulf South Research Inst.
Baton Rouge, La.

I would like to discuss our environmental pollution problems from a total environmental concept, rather than the specific problems related to vegetable processing. The gentlemen preceding me, all experts in this field, leave me nothing further to contribute to this specific area.

John Middleton, National Air Pollution Control Administration addressed a group at Louisiana State University last fall and commented that in the next 10 to 20 years we will have doubled our present population. Our national interstate highway program after ten years is somewhere near 50 percent completed—and we have known how to build highways for years! He pointed out that from the standpoint of air pollution, for many areas, we do not have 10 to 20 years to solve the problem nor do we have the technology.

For our water environment, we must make great analytical and technological strides—rapidly. For example, two abundant elements such as iron and aluminum are not properly measured. Our existing analytical methodology simply does not permit us to correctly measure the quantities present in a stream or water treatment plant. Both elements react with the fluoro, phosphato, exalto, formato, citrato, and tartrato complexes found in natural or treated waters or both. We are now measuring only the uncomplexed or free parts of the two elements, which probably represents only a small percentage of the total element present. These two elements were simply selected to illustrate our vast ignorance of the aqueous environment. Cyanides, more significant from a health standpoint, suffer from the same inadequate analytical methods as do many of the indicted carcinogens.

I recently visited the water reclamation project in Pretoria, South Africa.[1] They are successfully utilizing primary treated domestic effluent for introduction back into their municipal water supply. They are primarily depending upon the chemical oxygen demand test to tell them when the reclaimed water is suitable for introduction into the municipal supplies. Health authorities in the states would be most skeptical of this quality control. Their cost figures are very good, however, and they are developing technology that may be applicable with more rigid quality controls..

Two practices commonly being used at present are the burying and burning of solid wastes. Many States including Louisiana now have antiburning laws. These laws will provide substantial relief to the air pollution generated by burning. Is this not moving one problem to another area of the environment? Approximately 35 percent of our parishes have major water aquifers within 100 feet of the surface of the ground. With our sparse, scattered population, in many of the parishes landfill, or hopefully sanitary landfill, will be the only method for disposal of solid waste. Our 60 inches of rainfall per year, together with high water tables will now pose a problem of contamination of underground water supplies by the leachates from the landfills.

The development of better equipment and biological treatment for domestic and industrial waste has shown much progress. But again, are we moving the pollution problem from one area of the environment into another? We can successfully lower the oxygen demands by flocculation, settling, or biological treatment. But these approaches leave solid wastes to be disposed of. Concentrated nutrients from biological action must be removed or simply released to the aqueous or solid area of the environment.

In summary—I think I have only hit the high spots; I simply want you to think of it as a total environmental system and certainly not inexhaustible. We have a fixed amount of reasonable air, water, land, and uncontaminated soil. If we continue the approach of shifting pollution or merely changing the form of it or taking it out of one area of the environment and inadvertently placing it in another area, we aren't really solving the pollution problem. I have said what has been said many times before—that our research and development should be directed toward abatement of pollution by salvage rather than dispersion. New uses for our waste products are really the best approach, I feel, to the solution of pollution.

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[1] Stander and Van Vuuren, Reclamation of Potable Water from Waste Water, Jour. Water Pollut. Control Fed., Mar. 1969

W. A. Mercer
National Canners Association
Berkeley, Calif.

I stand before you as a staff member of the Research Laboratories of the National Canners Association, which has been in existence for over 50 years. I ought to know all the answers, but I don't. The reason, of course, is that determining the answers to the Industry's pollution problems is a complex procedure.

Since the beginning of the food processing industry, large sums of money and considerable amounts of time have been spent in testing various methods of handling and treating of food processing wastes. No one of these is universal in solving the problems. There are many serious problems to solve. There is not time, here today, to discuss the complexities of these problems.

With reference to research and development needs, I think that research ought to be directed or guided toward three general areas of investigation: (1) there ought to be the development of processing procedures which limit the water of the plant use to that volume which is absolutely necessary to carry out a sanitary, efficient operation. (2) I think we should give attention to selection and segregation of low-volume, high-strength waste streams for the purpose of separate treatment. And (3) there must be development and demonstration of methods designed to give complete or partial treatment of low-volume, high-strength waste streams. These methods of treatment ought to be applicable for on-site treatment.

Research should be done on in-field or in-orchard sorting and sanitizing of raw products for food processing. Whenever possible the raw product ought to be washed and otherwise handled in the field or the orchard to the extent necessary to allow the raw product to bypass the washing operation at the plant or at least allow drastic reduction of the amount of water used.

I think that in-field research should be directed towards the following: The mechanics and sanitation of the in-field sorting and washing operations; the initial quality of the wash waters used and reconditioning of these waters—if water scarcity is a problem or disposal of the water is a problem; and last, the proper handling and disposal of liquid and solid wastes to prevent pollution.

In regard to in-field washing, consideration should be given to the economics of transporting to the plant only usable products and not hauling to the plant the solid wastes that can be handled in the field, and also, not putting down the sewer those waters which would be used to cleanse the raw product in the field.

I think that research should be directed to the following in-plant considerations: Where water transport of fruit and vegetable is desirable, there should be necessary development of automated water research systems which keep water usage to a minimum.

Research should develop adequate control systems for maintenance of satisfactory sanitary conditions in the reused water by pasteurization, radiation, or any other means of controlling sanitary conditions. The degree of re-circulation and reuse of the water depends upon the sanitary condition of the raw product contacted by the water.

Consideration should be given to substitution of fluids other than water for transporting raw products. For example, why not pump cut fruits in corn syrup instead of pumping them in water. Our canneries out in some of the Western States are going more and more toward water transport of fruits. There's some production advantage in this, but we know, for example, that this increases BOD about three or four times, depending on the extent of water transport.

Attention ought to be given to modification of processing equipment design for prevention of product spillage. I agree wholeheartedly with Dr. Weckel when he pointed out some of the areas in which there is considerable waste because of spillage. Dr. Weckel suggested that there ought to be ways to inform the plant personnel and I certainly agree with that. I think it's an excellent idea. The Association's approach is to develop audio-visual materials which plant managers can use in educating their own plant personnel. We have in preparation an audio-visual which will discuss pollution problems in terms that the man who is operating the machinery can understand. We will try to point out his relationship to water pollution control.

I think that research is urgently needed to develop more effective and efficient methods of treatment for processing wastes. I think the research should be directed toward three areas of investigations. As I have already said, I think on-site treatment of certain selected wastes should receive attention. I think that the handling of treated wastes in streams should receive attention, and one point of interest here is the application of materials which coagulate the bacterial debris present in waste waters held in lagoons. Then, of course, there are many possibilities for the treatment of cannery waste with combinations of facilities and in combination with other types of waste waters. Referring again to on-site treatment of selected wastes, I think that research within this area of investigation should be directed toward recovery and utilization, as byproducts, of organic materials now being discarded.

There should be processes for concentration of the soluble organics in food processing wastes to give liquid which can be used for the production of syrup for use in animal feeds or the possible production of a substrate for growth of yeast or fungi to produce an edible protein. We are interested in membrane separation or membrane concentration of some of these soluble organics.

We are very interested in electro-chemical oxidation of organics in selected waste streams. I think that waste streams containing soluble animal proteins may certainly be treated with coagulants and floc removed for some final treatment or use. With reference to general industry problems, I'd like to point out some of the urgent needs of the day. I think we ought to define industry problems and catalog our needs in water pollution abatement. We must say whether these needs are technical or economic problems or both. I think we need to, above all, do research both industry-supported and government-supported, on these problems. In some of the problem areas, the research work needs to be large-scale demonstration-type experiments which develop technical and economic data for use by industry in evaluating the feasibility potential of treatment processes.

And if I might add one final point, I think there is a need for university refresher courses for engineers involved in the design of systems for treatment of food waste waters.

SUMMARY

by

W. W. Eckenfelder, Jr.
The University of Texas
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I would like to direct my summary to the comment that of all the many conferences I have attended through the years, the many programs and seminars, that this session has probably done the best job of defining a problem and setting a jump-off point. I think all of us in this room today recognize that we have a problem. At least now we have some idea of both what the problem is and what is being done to attempt to get an answer.

Dr. Mercer indicated that we get four to five units of waste product for each unit of final product, therefore emphasizing the gross magnitude of this problem, particularly when compared to most other industries.

Mr. Lafleur has quite aptly shown that the industrial influx, particularly in this part of the country, is going to enhance the wastewater treatment problem. This will undoubtedly lead to increasing requirements for the design of waste treatment plants.

I couldn't help but smile at Jim Coerver's discussion of the problems encountered when vegetable processing wastes are discharged into our domestic systems. This does not imply that it is impossible to combine domestic and cannery waste, but rather emphasizes the need for developing engineering guidelines and engineering criteria, such as equalization pretreatment, and pH adjustment. It is quite obvious that these criteria must be extended both to operating and initial design.

A very informative panel discussed plant problems and possible corrective measures. It is of interest to note that almost invariably treatment of vegetable processing waste is accomplished at the present time in lagoons or irrigated basins with removal of solids by screening and in some cases, sedimentation.

The dependability of these processes and the elimination of operating problems are subjects of considerable concern as has been aptly brought out by the panelists in the discussions at this meeting.

My personal opinion is that one of the most useful topics for research lies in waste control by process modification as discussed by Mr. Huxsoll. This is perhaps more significant in the vegetable processing industry than in many others. Dry caustic peeling of potatoes is a significant step in this direction.

A panel covering the commercial processes presently in use gave informative information on various commercial processes available to the vegetable processing industry. The panel discussed removal of solids by screening and sedimentation, various new biological treatment processes, trickling filters, and various other process modifications. The panel offered several alternative approaches to initiating and executing water pollution control programs.

Research and development needed can be considered a closing and keynote to this meeting, which was obvious to me as it must have been to each of you for the previous reasons that many gaps in our knowledge and understanding of vegetable processing problems need to be filled. Dr. Weckel discussed in-plant control to reduce product loss and hence, a decrease in waste water. Peas were cited as an example of how reducing product loss is a logical first step in any waste conservation program. Water and heat conservation were also emphasized.

The need for a research and development program to actively eliminate a particular problem was emphasized by Roy Weston. Long-range approaches directed toward the impact of pollution need to be included in all future considerations.

Eckenfelder cited the need for research and design criteria in waste treatment processes in common use today.

The impact of pollution in a troubled environment was brought out by Mrs. West. She also brought out the dangers of considering only the component problems in society.

One of the three areas of research emphasized by Dr. Mercer was on-site treatment and development of newer wastewater treatment processes. Dr. Mercer quite aptly closed the panel with the comment that we don't have all the answers.

HIGHLIGHTS OF THIS CONFERENCE

Marie A. Jones
Southern Utilization Research and Development Division
New Orleans, La.

Conference on Vegetable Processing Wastes Called Success:

A number of ways for alleviating the problems of pollution arising from the operations of food processing plants were suggested at this conference held in New Orleans on August 26. Several promising directions for research and development were also suggested.

The conference, sponsored by USDA's Southern Utilization Research and Development Division (SURDD), the Louisiana Sweet Potato Commission, and the Horticulture Department of Louisiana State University, Baton Rouge, was organized in response to recommendations by representatives of the Louisiana food processing industry, particularly Bernard F. Trappey, founder of B. F. Trappey's Sons, Inc., and chairman of the Sweet Potato Commission, and representatives of Bush Bros. and Company, who operate several plants in Louisiana.

As co-chairman of the program committee, B. H. Wojcik of SURDD, was largely responsible for arranging the conference.

Randolph J. Trappey, Jr., of B. F. Trappey's Sons, Inc., presided at the meeting as general chairman.

Dr. C. H. Fisher, Director of the SURDD, set the tone for the meeting in his opening remarks, when he stated that pollution problems can be handled adequately if two broad conditions are met:

First, there should be a full awareness of the problem, and the determination to solve it, and,

Second, the necessary technology should be available or attainable.

He expressed optimism that both of these conditions are being met.

In summing up the conference at its close, W. W. Eckenfelder, Professor of Environmental Health Engineering at the University of Texas, said that of all the conferences on the subject he has attended this was one of the best, from the standpoint of defining the problem and giving a jumping off point from which to work toward solutions.

There were several salient points on which everyone concerned appeared to agree. Among these, several of which were brought out by various speakers, were:

1. Take steps to reduce the amount of waste that must be disposed of, either through modification of processes, or by developing uses for these materials, so that the waste would bring a financial return instead of creating additional expense.

2. Reduce the amount of water requiring treatment, thus reducing the treatment load. This could be done, it was said, by cutting down the amount of water used in processing, and by the reuse of water, for example, keeping clean water used for can cooling separate from waste-bearing water.

3. A general tightening up of operations, particularly through better training and education of plant personnel responsible for plant operations. In most instances these procedures would not only aid in solving pollution problems, but would actually cut down expenses, or increase returns. Eliminating the use of unnecessary amounts of water, for example, could reduce significantly the amount of power or fuel required to heat the water.

In his opening session remarks Randolph Trappey expressed the feeling of Louisiana processors in regard to pollution of the state's waters when he said that as lifetime residents and property owners in the area where the Trappey plants are located they are concerned with the effects of such pollution on their own environment, as well as with meeting requirements of the Federal Water Pollution Control Act.

Walter A. Mercer, associate director of the National Canners Association Research Laboratories, Berkeley, Calif., said the present food-population crisis is the chief threat to world peace, and that there must not be any precipitous action (in water pollution control) which seriously hinders the production and preservation of food. On the other hand, while the quantity of water in our Nation's streams has been decreasing, the quantity of wastes discharged to our streams has been increasing as population and industry grow. Food growing and food processing must produce and accumulate waste materials, and the increasing mechanization under mounting economic pressures are causing a measurable increase in these waste materials.

For these reasons he urged processors to consider the possibility that some pre-processing operations should be done in the field or orchard, leaving there the solid refuse and waste waters to be handled by methods that prevent water pollution and other nuisance conditions. Also, water use in the processing plant should be reduced to the lowest volume possible and still allow an efficient and sanitary operation. Plant engineers should keep this in mind when new equipment is installed or other plant modifications are made.

Finally, he stressed that the problem of pollution must be met. Government-supported research must continue and be expanded. Research must design large-scale, demonstration projects which will test the economic, as well as the technical feasibility of various waste handling and treatment methods.

During the morning session Edward I. Daniel, Princeville Canning Co., St. Francisville, La., presided over a panel discussion in which five representatives of Louisiana processing plants outlined waste disposal procedures, and attendant problems. Members of the panel were H. Lowell Fitzgerald, plant engineer for Bush Bros. and Co., Dandridge, Tenn., a firm which operates two plants in Louisiana; Randolph J. Trappey, Jr., Lafayette; George B. Statham, United Foods, Inc., Hammond; Gordon S. Brown, Bruce's Foods, Inc., New Iberia; and Hollis W. Horton, King Pharr Canning Operations, Inc., Oak Grove.

The method of waste disposal in common use appeared to be some type of lagooning, with subsequent discharge into either a stream or a municipal sewerage system. Solid waste is screened out of the liquid before it goes into a lagoon, and some of the plant operators said that this was being used by farmers as stock feed or fertilizer.

One operator said they use an anaerobic pond, about an acre in size and tightly covered with plastic. After a residence time of about 30 days the liquid is drained into a larger, open lagoon, from there to the municipal system and discharged into the river.

One speaker said that contaminated water from the caustic peeling process was their chief problem, and expressed an interest in a process used by the paper industry, in which cellulose is dissolved, the cellulose-caustic solution evaporated, and the residue used for heating boilers.

Another plant man said that they have used ferric chloride to coagulate out about one-third of the suspended solids in waste water. They are now conducting pilot-plant trials of the dry caustic peeling process developed at the Western Utilization Research and Development Division (WURDD). The trials are being conducted in cooperation with the WURDD and SURDD.

The consensus of the panel seemed to be that their principal problem is the separation of the solid from the liquid waste and disposal of the solid material.

The final speaker on the panel, Robert A. Lafleur, executive secretary of the Louisiana Stream Control Commission, Baton Rouge, said the commandment of the Federal Water Quality Control Act of 1965 is, "Thou shalt not pollute," but that the second most important use of streams is to carry off waste, without interference with other uses. There has been an industrial influx amounting to about $3 billion in Louisiana since 1961, chiefly oil, gas, and sulfur processing plants, of which 70 percent is located on the Mississippi River and 20 percent in the Lake Charles area, with all of these operations adding to the pollution problem. He mentioned some of the problems caused by the leaching of pesticide residues into streams, as in 1958, when chlorinated hydrocarbons (no longer in use) caused large fish kills.

Operations of various industries in the State are being reviewed.

In the panel discussion some of the plant operators mentioned difficulties in connection with the discharge of processing plant wastes into municipal water systems. James F. Coerver, Head of the Engineering Division of the Louisiana State Department of Health used several examples in which various problems had been encountered. He recommended that solids should be screened out; that efforts should be made to feed wastes uniformly into the sewer system; separate caustic peel liquors; and to keep in mind the fact that waste from vegetable processing plants, sweetpotatoes, for instance, is largely carbohydrates, but not so in domestic sewage, so that the two require different treatment.

Mr. Coerver urged the installation of screens to remove suspended solids. A six-mesh screen will do the job, and rotary or vibrating screens are not expensive. The dewatered sludge could probably be sold for feed.

Waste control by process modification, an approach considered of growing importance, was discussed by Charles C. Huxsoll, of WURDD, one of the developers of the "dry" caustic process for peeling potatoes. This process is already in use for the peeling of white potatoes, and pilot plant trials with sweetpotatoes are being conducted in Louisiana.

Peeling is the chief source of waste from fruit and vegetable canning. "Dry" caustic peeling is a modification designed to remove the peel with a minimum amount of water. Dr. Huxsoll showed a motion picture film of the process. He also cited a procedure developed at WURDD, in cooperation with the National Canners Association, whereby brine is filtered through activated carbon and can then be reused. He mentioned work done at USDA's Northern Utilization Research and Development Division on procedures for handling waste from grain processing, and at the Eastern Utilization Research and Development Division on recovery of protein from potato wash water.

In opening his address on Federal research and development program for the control of industrial water pollution, William J. Lacy, of the Federal Water Pollution Control Administration, Department of the Interior, Washington, D.C. said silt is the world's oldest pollutant, and millions are spent to filter out silt and make water usable. Sewage, however, is the type of pollution that is a major concern, because bacteria in it can cause typhoid fever, cholera, hepatitis, and dysentery.

Now there are thousands of new wastes from industrial and chemical plants, so complex in composition and so stable in water that they are scarcely affected by conventional treatment methods. Heat also is a growing pollution problem. Water is used for cooling, and discharged into streams while still so hot it increases the danger of dissolved chemicals, it slows down the natural purifying process of moving water, and it kills fish.

The Water Quality Act of 1965 provided Federal standards of water quality, and established the FWPCA. In 1966 the new agency was placed in the U.S. Department of the Interior; enactment of the Clean Water Restoration Act followed in November 1966. The authorization not only vastly increased Federal grants for construction of sewage treatment plants, but also for research, development, and demonstration of new or improved methods in municipal, industrial, and joint waste treatment fields. It has three components, an in-house effort, a grants program, and a contract program. More than 80 percent of the monies available to FWPCA for research, development, and demonstration are used for grant and contract payments. For the first time, industry may participate in these grant programs. The grant recipient may construct a permanent waste treatment facility on its own property to develop and demonstrate new or improved methods for preventing pollution by industrial wastes, methods which have industrywide application. These grants can pay up to 70 percent of the project costs, to a maximum of $1 million.

Commercial processes presently in use were described in a panel discussion by representatives of several equipment and materials manufacturing firms, including: George Ehinger, Dorr-Oliver, Inc., Stamford, Conn.; Fred M. Welch, Allis-Chalmers Manufacturing Co., West Allis, Wis.; Edgar G. Paulson, Calgon Corporation, Pittsburgh, Pa.; Charles B. Grimes, Rex Chainbelt, Inc., Milwaukee, Wis.; James J. Davies, Dow Chemical Company, Baton Rouge, La.; Gerald V. O'Connor, Monsanto-Biodize, College Point, N.Y.; and A. J. Freedman, Nalco Chemical Company, Chicago, Ill.

Kenneth G. Weckel, professor of the Department of Food Science and Industries, University of Wisconsin, Madison, presided over the session.

The final presentation of the day was another panel discussion on "Research and Development Needed," with D. W. Newsom, Head of the Department of Horticulture, Louisiana State University, as moderator.

The first speaker, Dr. Weckel, brought forward the suggestion that more information is needed about the blanching process. He said they have found wide variations in the amount of soluble solids in water used for blanching different lots of the same size. Overblanching causes losses of the salable product, and increases the load in pollution waste. There should be research projects to explore the potential of vacuum packing, and of blanching by means of water, steam, hot air, and fluid bed.

He also recommended a study of suspended solids. At the University of Wisconsin studies showed that various screens failed to reduce adequately the biological oxygen demand (BOD) of corn waste. Information is needed about the colloidal particles. Likewise, they found that leaching at different stages of processing produced a wide range of variation in solids and in the BOD of the effluent.

The average plant also needs much more effective control of water used in the various processes. Over use of water is costly in the treatment of waste; also, the amount of water used can be related to the cost of heat, a significant item.

In discussing these problems with men in the plants, he said, he has found that they are not familiar with such terms as BOD (biological oxygen demand), COD (chemical oxygen demand), suspended solids and soluble solids, and that in Wisconsin they have instituted a 2-day conference for key plant men.

He also called attention to spillage at such points as can fillers. In closing he challenged his audience to

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ATTENDANCE OF PERSONNEL FROM THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION FOR AT LEAST ONE SESSION OF THE CONFERENCE

Berry, Robert E. (Dr.)—U. S. Fruit and Vegetable Products Laboratory, Winter Haven, Fla.
Brysson, Ralph J.—Cotton Finishes Laboratory
Carpenter, Frank G. (Dr.)—Food Crops Laboratory
Deobald, Harold J. (Dr.)—Food Crops Laboratory
Dollear, Frank G.—Oilseed Crops Laboratory
Fayette, Alton F.—Administrative and Plant Management
Fisher, C. H. (Dr.)—Director
Frampton, Vernon L. (Dr.)—Cotton Physical Properties Laboratory
Gallo, Alexander S.—Engineering and Development Laboratory
Gardner, Homer K., Jr.—Engineering and Development Laboratory
Griffiths, F. P. (Dr.)—U. S. Food Crops Utilization Research Laboratory, Weslaco, Tex.
Hughes, James P.—Director's Office
Jones, Marie A.—Public Information Office
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Lambou, Madeline G. (Mrs.)—Engineering and Development Laboratory
McFarlane, Vernon H. (Dr.)—Food Crops Laboratory
Mottern; Hugh H. (Dr.)—Engineering and Development Laboratory
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Walker, Merlin H.—Plant Management
Williams, Nancy R. (Mrs.)—Economic Research Service
Wojcik, Bruno H. (Dr.)—Assistant Director
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